UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

RECORD OF DECISION

PART I: DECLARATION

PART II: DECISION SUMMARY

PART III: RESPONSIVENESS SUMMARY

RHONE POULENC/ZOECON/SANDOZ SUPERFUND SITE

EAST PALO ALTO, CALIFORNIA

MARCH 4, 1992

U.S. ENVIRONMENTAL PROTECTION AGENCY

REGION 9

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DECLARATION

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DECLARATION

1.0 SITE NAME AND LOCATION

RHONE POULENC/(ZOECON) SANDOZ
SAN MATEO COUNTY
1990 Bay Road
East Palo Alto, California

2.0 STATEMENT OF BASIS AND PURPOSE

This Record of Decision ("ROD") presents the selected remedial actions for the Rhone Poulenc/(Zoecon)Sandoz Superfund site in East Palo Alto, California. This document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. Section 9601 et. seq., and to the extent practicable the National Oil and Hazardous Substances Pollution Contingency Plan, 40 C.F.R. Section 300 et. seq., ("NCP"). EPA issues this Record of Decision pursuant to section 104 of CERCLA, and has selected the remedial action in accordance with section 121 of CERCLA. As provided in section 121 (e)(i) of CERCLA, no federal, state or local permit shall be required for the portion of any remedial action conducted entirely onsite, when such remedial action is carried out in compliance with section 121. This is considered an Operable Unit Record of Decision. Investigatory work related to this site is ongoing, and could potentially lead to additional CERCLA actions, or actions pursuant to other statutory authority, at this site. This decision is based on the administrative record for this site.

The State of California concurs with the selected remedy.

3.0 ASSESSMENT OF THE SITE

Actual or threatened release of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

4.0 DESCRIPTION OF THE REMEDY

The remedial actions address a principal threat at the Rhone Poulenc/(Zoecon) Sandoz site by treating the highly-toxic source materials that are present in soil thereby significantly reducing the mobility and/or volume of hazardous substances in the media. The toxicity of arsenic would not be changed by this particular treatment process.

This action represents the final remedial action to remove contaminants from soil in the Upland Operable Unit. The selected remedy for the site is Alternative E described in the Remedial Investigation/Feasibility Study and Proposed Plan. It will take approximately 9 months to complete the soil stablization work and the estimated cost of the remedy is $9,100,000. The major components of the selected remedy shall include the following:

- institutional controls (deed restrictions) prohibiting future residential use of the Sandoz and Bains properties;

- excavation of soils containing arsenic concentrations greater than 5000 mg/kg (excavation in accessible areas occured during September 1991). Soil having arsenic concentrations greater than 5000 mg/kg in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties shall be excavated when the facility ceases operation and structures are demolished;

- excavation and/or paving of soils having concentrations above health-based cleanup standards (> 70 mg/kg As) on all properties except for Sandoz and Bains. Institutional controls (deed restrictions) prohibiting future residential use shall be obtained for properties where paving is selected;

- treatment of soils containing arsenic concentrations greater than 500 mg/kg arsenic using a silicate stabilization technology. When contaminated soil located beneath buildings is accessible, this contaminated soil shall be treated using the same remedial standards listed above.

- o continued annual groundwater monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The details of the contingency plan are outlined in the following reports: Deep Aquifer Monitoring Plan, Revised Sampling and Analysis Plan, and the Aquifer Contingency Plan. The contingency plan requires groundwater extraction and treatment if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

- o installation of a slurry wall with dewatering. The slurry wall shall surround the area containing contaminated soil and ground water remaining after soil remediation. It will enclose 76,800 yd^3 of soil (84% of the contaminated soil in the upland operable unit) and 43,200 kg of arsenic (58% of the arsenic). Groundwater extraction and treatment within the slurry wall is necessary to maintain the inward hydraulic gradient across the slurry wall. Based on currently available technologies, extracted groundwater shall be treated in a precipitation/microfiltration process.

- o installation of additional deep aquifer monitoring wells. The site shall contain a minimum of three well pairs that will monitor the upper shallow zone, the lower shallow zone, and the deep aquifer zone;

- o installation of a cap and liner on the currently unpaved portions of the Sandoz property, the Bains railroad track area, and portions of the PG&E poleyard, and the Curtaccio, Rogge, and Demeter properties.

5.0 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions, an innovative technology (silicate fixation of arsenic soils) and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

John Wise
Deputy Regional Administrator

Date

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

John Wise
Deputy Regional Administrator

3.4.92
Date

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne Street

San Francisco, Ca. 94105-3901

CONCURRENCES FOR
RHONE POULENC INC/ZOECON CORP SUPERFUND SITE
RECORD OF DECISION

I concur with the remedy selected for the RHONE POULENC INC/ZOECON CORP Superfund site and recommend that the Deputy Regional Administrator sign the Record of Decision.

Jeff Zelickson, Director
Hazardous Waste Management Division

3/4/92
Date

Keith Takata
Assistant Director for Superfund
Hazardous Waste Management Division

3-4-92
Date

Dave Jones, Chief
Hazardous Waste Management Division

3/4/92
Date

Jim Hanson, Chief
South Bay Section
Hazardous Waste Management Division

3/4/92
Date

Rose Marie Caraway
Remedial Project Manager
Hazardous Waste Management Division

3/4/92
Date

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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CONCURRENCES FOR
RHONE POULENC INC/ZOECON CORP SUPERFUND SITE
RECORD OF DECISION

I concur with the remedy selected for the RHONE POULENC INC/ZOECON CORP Superfund site and recommend that the Deputy Regional Administrator sign the Concurrence Record of Decision.

Harry Seraydarian, Director
Water Management Division

3/4/92
Date

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, Ca. 94105-3901

DECISION SUMMARY

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PART II. DECISION SUMMARY

This Decision Summary provides an overview of the problems posed by the Rhone Poulenc/(Zoecon)Sandoz site ("the Study Area"), the remedial alternatives, and the analysis of the remedial alternatives. This Decision Summary explains the rationale for the remedy selection and how the selected remedy satisfies the statutory requirements of CERCLA.

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 SITE NAME AND LOCATION

Rhone Poulenc/(Zoecon)Sandoz
1990 Bay Road
San Mateo County
East Palo Alto, CA

Rhone-Poulenc, Inc
P.O. Box 125
Black Horse Lane
Monmouth Junction, NJ 08825

Sandoz Crop Protection Corporation
Corporate Headquarters
1300 East Touhy Avenue
Des Plaines, Ill 60018
708-699-1616

The Rhone Poulenc/(Zoecon)Sandoz site consists of the property located at 1990 Bay Road in the City of East Palo Alto and contiguous lands. Contamination is present on 13.19 acres of which 5.19 acres is currently owned by Sandoz Crop Protection Corporation and 8 acres is owned by the adjacent property owners to the west, south and east. The adjacent properties include those owned by J. G. Torres, Incorporated (includes former Call-Mac Property), Pacific Gas and Electric Poleyard, Borrmann Steel Company, Inc., Ronald G. Rogge, Michael Demeter, Melvin Curtaccio, the City of East Palo Alto, and the City of Palo Alto. Figures 1.1 - 1.3 show site location, site boundaries, and property boundaries.

The site is located about 2000 feet east of San Francisco Bay and about 4500 feet northwest of San Francisquito Creek, a tributary of the Bay. Tidal and non-tidal marshes border the site on the east and southeast. The non-tidal marshes are bounded by levees with a portion constructed before 1939 and another portion by 1955.

The City of East Palo Alto lies in a relatively flat lying portion of the Santa Clara Valley approximately 35 miles south of San Francisco (see Figure 1.1). Ground surface elevations are generally between 6 feet and 8 feet above mean sea level. This is an industrial setting, dominated by auto wrecking yards and a large chemical recycling company.

Surface water at the site and vicinity includes seasonally ponded water along the west side of the levee, San Francisco Bay water in the tidal marsh, and San Francisco Bay to the east of the marsh. Water ponds in isolated low-lying areas up to depths of three feet. At higher water depths isolated ponds merge to form a fairly continuous body of water between the non-tidal marsh and the former Call-Mac (Torres) property. Surface water from the Sandoz Plant area runs off into a lined ditch located along the eastern boundary of the plant. A gate valve at the southern end of the ditch controls run-off between the ditch and the low-lying Call-Mac property. Surface water from the PG&E poleyard ponds locally in shallow depressions and infiltrates the area or evaporates. Most of the surface run-off from the substation is discharged into the non-tidal marsh via a 2-inch diameter plastic pipe. The closest subsurface storm drainage system for the site extends along Bay Road from Demeter Street to the intersection of Pulgas Avenue and Bay Road (about 500 feet to the west of the site), where it turns south along Pulgas and connects to storm drains on Weeks and Runnymede Streets. Figure 1.4 shows site surface drainage patterns.

A tidal marsh over 1,000 feet wide exists between the levee and San Francisco Bay. The tidal marsh is drained by a network of tidal channels, however, the marsh surface within 200 feet of the levee is frequently exposed because the surface elevation is greater than the mean high tide level.

There are approximately 20,000 people within a two-mile radius of the site, with the closest residence located about 500 feet southwest of the site, at the northeast corner of Pulgas Avenue and Weeks Street. None of these residential areas are within the area impacted by the past chemical releases from the Rhone Poulenc site. There are approximately seven schools and playgrounds within the 1.5 miles surrounding the site. The closest school is located .27 miles south of the site. The Ravenswood Children Center located at 1286 Runnymede Avenue has 185 students. Figure 1.5 shows a survey of businesses and residences within a quarter mile radius of the site. There are fishing areas, hiking trails, and a nature preserve located in the wetlands adjacent to the site.

1.2 REGIONAL TOPOGRAPHY

The Study Area is located near the edge of the Santa Clara

Valley which extends southeast from San Francisco Bay and is bounded by the Diablo Range to the northeast, and by the Santa Cruz and Gabilan Ranges on the southwest (see Figure 1.6).

The Santa Clara Valley is a large structural depression in the Central Coastal Ranges of California. The Valley is filled with alluvial and fluvial deposits from the adjacent mountain ranges. These deposits are up to 1,500 feet in thickness. At the base of the adjacent mountains, gently sloping alluvial fans of the basin tributaries laterally merge to form an alluvial apron extending into the interior of the basin.

1.3 CLIMATOLOGY

The East Palo Alto area has pronounced wet and dry seasons with mild wet winters and warm dry summers characteristic of a Mediterranean climate. The area lies in the path of winter storms which periodically sweep inland from the North Pacific. Freezing temperatures and snow are extremely rare. Rainfall from the winter storms range from moderate to heavy. Precipitation data is available from the many weather stations in the area. Records show the average annual rainfall to be about 15 inches. The site averages approximately 10 to 14 inches of rainfall per year. Over 75% of the total annual rainfall in this area occurs during the winter months of November through March. The average annual wind speed is approximately 6 to 7 mph (about 3 m/sec) with slightly stronger winds occurring in the summer. Winds in the area are predominantly from the west northwest.

1.4 ADJACENT AND HISTORICAL LAND USE

The East Palo General Plan establishes land use within the city. The site is part of the Ravenswood Industrial Park, which is zoned as either light industrial (M-1) or heavy industrial (M-2). The areal extent encompasses the area south of the site to a line 110 feet north of Weeks Street, north of the Dumbarton Bridge Road (about one mile), and west of the site to the Southern Pacific right-of-way (about 1500 feet).

The site also lies within the 186-acre area designated as the Ravenswood Redevelopment Project by the East Palo Alto Redevelopment Agency (EPARA). The goal of the agency is to evaluate redevelopment concepts for the Ravenswood Project. EPARA adopted the Ravenswood Redevelopment Plan in 1990 which states that the area would maintain its industrial status. The closest residences are approximately 500 feet southwest of the site.

Planned land use outside the industrial zone is varied, including high-density housing a number of blocks to the south,

recreational use along the dike area, possible development of Cooley Landing as a marina approximately a quarter of a mile to the east, continued use of the marsh as a wildlife and bird-watching habitat, and continued medium-density housing in the area a quarter of a mile to the west.

1.5 HYDROGEOLOGY

Regional Hydrogeology

The Santa Clara Valley groundwater basin is divided into two broad areas: 1) the forebay, and 2) the confined area. The forebay occurs along the elevated edges of the basin where the basin receives its principal recharge(see Figure 1.7). The confined area is located in the flatter interior portion of the basin and is stratified or divided into individual beds separated by significant aquitards. The confined area is divided into the upper and lower aquifer zones. The division is formed by an extensive regional aquitard that occurs at depths ranging from about 100 feet near the confined area's southern boundary to about 150 to 250 feet in the center of the confined area and beneath San Francisco Bay. Thickness of this regional aquitard varies from about 20 feet to over 100 feet.

Several aquifer systems occur in the upper aquifer zone separated by aquitards which may be leaky or very tight. Groundwater contamination at the site is confined to the zone within the upper aquifer zone. The lower aquifer zone occurs beneath the practically impermeable regional aquitard. Numerous individual aquifers occur within this predominantly aquitard zone and all groundwater in this zone occurs confined.

Site Hydrogeology

A shallow aquifer exists as two zones between 5 and 35 feet below ground surface and a deep aquifer occurs below a depth of 160 feet. The shallow aquifer is underlain by about 100 feet of low permeability clay which separates it from a deeper aquifer used further inland for water supply. The shallow aquifer consists of interbedded silts, clayey silts, and sand lenses. A relatively continuous sand lens occurs at a depth of about 5 to 15 feet below land surface, and a second relatively continuous sand lens occurs within the depth interval at about 20 to 35 feet. Site documents refer to the depth interval from about 5 to 15 feet as the upper shallow groundwater zone, and the depth interval from about 20 to 35 feet as the lower shallow groundwater zone. Figures 1.8 - 1.11 show hydrogeologic cross sections for the site.

The background water quality of the shallow aquifer is poor. The total dissolved solids concentrations range from 570 mg/l up to 30,000 mg/l. The deep aquifer is of drinking water quality in

areas of East Palo Alto, Menlo Park, and beneath the site. The total dissolved solids concentrations in these wells range from 420 mg/l to 746 mg/l. The direction of groundwater flow in the shallow aquifer is generally toward the south and southeast with some evidence of seasonal fluctuations. The rate of groundwater flow in the shallow aquifer was estimated to be in the range of 10 to 60 feet per year. The calculated rate of arsenic movement in the more permeable deposits in the upper 40 feet is no more than about 4 feet per year. The average rate of arsenic movement is about one foot per year.

From the late 1970's through the summer of 1988, downward vertical migration of the groundwater plume was not possible because the vertical groundwater gradient between the shallow aquifer and the deep aquifer was upward. Since the summer of 1988, as a result of pumping in the deep aquifer in the Palo Alto area due to drought, the vertical gradient has been downward. Calculated rates of vertical migration of the groundwater plume are less than one inch per year. Contaminants in the shallow aquifer would have to migrate over 110 feet downward through the silty-clay aquitard to reach a drinking water source.

Estimated hydraulic conductivities in the upper shallow groundwater zone are in the range to 8.5 ft/day to 28 ft/day, and are in the range of 20 ft/day to 85 ft/day in the lower shallow groundwater zone. These values are within the range reported for silt and silty sand. The estimated average hydraulic conductivities in the upper and lower shallow groundwater zones at the site are 23 and 28 ft/day, respectively. Horizontal hydraulic gradients for groundwater moving away from the site range from 0.0004 to 0.001 ft/ft. Assuming an average hydraulic conductivity of 23 ft/day and an effective porosity of 0.25 for the upper shallow groundwater zone, the pore (interstitial) velocity is estimated to range from 13 to 34 ft/year for groundwater traveling off site. Assuming an average hydraulic conductivity of 28 ft/day, a horizontal hydraulic gradient of 0.001 ft/ft, an effective porosity of 0.25 for the lower shallow groundwater zone, the average pore velocity for this area is 40 ft/year.

The RI report noted that groundwater from the shallow groundwater zone may be discharging at a slow rate to the non-tidal marsh, where it evaporates, and/or to the tidal marsh located to the east and south of the site. Groundwater discharge to the tidal marsh is most likely to the tidal channels. A relatively large tidal channel along the west side of the tidal marsh located southeast of the site may provide an area of discharge for the shallow groundwater zone.

The site and vicinity is located within the 100-year coastal flood zone classified by the Federal Emergency Management Agency (FEMA) as Zone A. The FEMA flood elevation for the site and vicinity is 7 feet NGVD. The site is located within the flood zone for the following reasons:

a) location on low-lying lands adjacent to San Francisco Bay and San Francisquito Creek
b) accumulation of surface run-off from adjacent areas during storms
c) presence of high water table.

1.6 WATER USE

There are a number of beneficial uses of the surface water and groundwater. Local surface waters include ponded water in the non-tidal marsh area on the west side of the dike, tidal waters in the marsh on the east side of the dike, San Francisquito Creek and the Bay itself. The groundwater at a depth of 150 feet or more is a drinking water source.

Historically, extensive groundwater pumping has occurred from the alluvial deposits on the perimeter of San Francisco Bay. Groundwater from sand and gravel zones below 160 feet was the main source of water supply for the cities along the western shore of San Francisco Bay until the 1960s. To prevent saltwater intrusion into the aquifers and to thwart land subsidence pumping was curtailed in the 1960s.

Water wells completed in aquifers deeper than 150 feet below land surface are used by three water supply companies in the area. All of these wells are located upgradient of the site with respect to the shallow permeable zones and are more than 3000 feet west and northwest of the 1990 Bay Road site. The San Mateo County Public Works Department operates a well at Bay Road and Gloria Way, which is located approximately 3500 feet west of the site. In 1988 this well was pumped and used for street sweeping. The Palo Alto Park Mutual Water company operates five wells located approximately 5400 feet west of the site. These five wells supply about 1300 gallons per minute in summer and half this amount in the winter. The O'Connor Cooperative Tract operates two wells approximately 7500 feet southwest of the site and they pump a total maximum of about 525 gallons per minute. A well on the east end of Bay Road is used exclusively by a boat repair facility, and the Iwasaki well is used by Saturo Iwasaki Greenhouses for agricultural purposes. The Spring Valley Water Company constructed the Ravenswood wells as water supply wells in the tidal marsh east of the site in the early 1900s. These wells were artesian until 1928. The wells were abandoned improperly and saltwater entered many of the wells at high tide. The wells were eventually filled and sealed.

The area which includes the 1990 Bay Road site and vicinity is served by the East Palo Alto County Waterworks Company, which receives most of its supply from the Hetch Hetchy surface water supply system. The Hetch Hetchy Aqueduct carries surface water

from the Sierra Nevada Mountains about 120 miles to the east. There is no apparent mechanism by which domestic water supply systems could be impacted by site contaminants. Approximately, 56,000 people are served by the Palo Alto water supply system, and 4,300 residents of East Palo Alto receive 2000 acre feet of their water from the Hetch Hetchy Reservoir. Groundwater currently accounts for zero percent of the municipal water supply. However, there is one domestic well installed and when the water suppliers start pumping from this well groundwater could account for up to 10% of the water being delivered to East Palo Alto.

The existing and potential beneficial uses of the surface waters (San Francisco Bay and San Francisquito Creek) and marshes include:

a. contact and non-contact water recreation
b. warm and cold fresh water habitat
c. fish migration and spawning
d. commercial and sport fishing
e. rare and endangered species preservation
f. estuarine habitat
g. wildlife habitat
h. salt marsh habitat
i. navigation
j. shellfish harvesting
k. industrial service supply

Existing and potential beneficial uses of currently uncontaminated groundwater in the vicinity of the site within the shallow and deep aquifers could be adversely affected if the spread of contamination remains uncontrolled.

The existing and potential beneficial uses of the groundwater underlying the site include industrial process water supply, industrial service water supply, municipal and domestic water supply, and agricultural water supply.

1.7 SURFACE AND SUBSURFACE FEATURES

The non-tidal marsh is owned by Pacific Gas and Electric (PG&E) and consists of a triangular area separated from the tidal marsh(located to the east) by a levee that rises approximately four feet above the area. The area is primarily covered by wetland vegetation, with some barren areas, and is submerged during the rainy season. The surface elevation in this area varies from 5 to 7 feet along its western boundaries to approximately 3 feet along the levee.

The PG&E poleyard, consists of a fenced rectangular, 3/4 acre plot of unvegetated land that is essentially level at an average elevation of 6.5 feet. Shallow ponding occurs during the rainy season.

The area north of Bay Road, is partially owned by the City of East Palo Alto, Ronald G. Rogge, and Michael Demeter. The predominant business in this area is auto wrecking yards. This area is mostly level, and the street is paved.

The northern portion of the Sandoz property, occupies approximately 2 acres and is generally level at an average elevation of 7 feet above mean sea level. It is undeveloped and was partially covered by low, grassy vegetation, with some barren areas. This portion of the site was the location for the former sludge pond. The entire perimeter is enclosed by chain-link or wooden fences. During the rainy season, surface water tends to pond locally to depths of a few inches.

The sludge pond was in existence between the 1950s and Rhone-Poulenc's plant closure in 1971, as confirmed by aerial photographs taken between 1955 and 1969. The pond was reportedly a rectangular unlined impoundment surrounded by a three-foot high berm. Liquid wastes, rinsate from Tank L, and damaged containers and products are suspected to have been disposed in the sludge pond. The pond was filled with lime, excavated soil, and berm materials when the pond was closed in 1971.

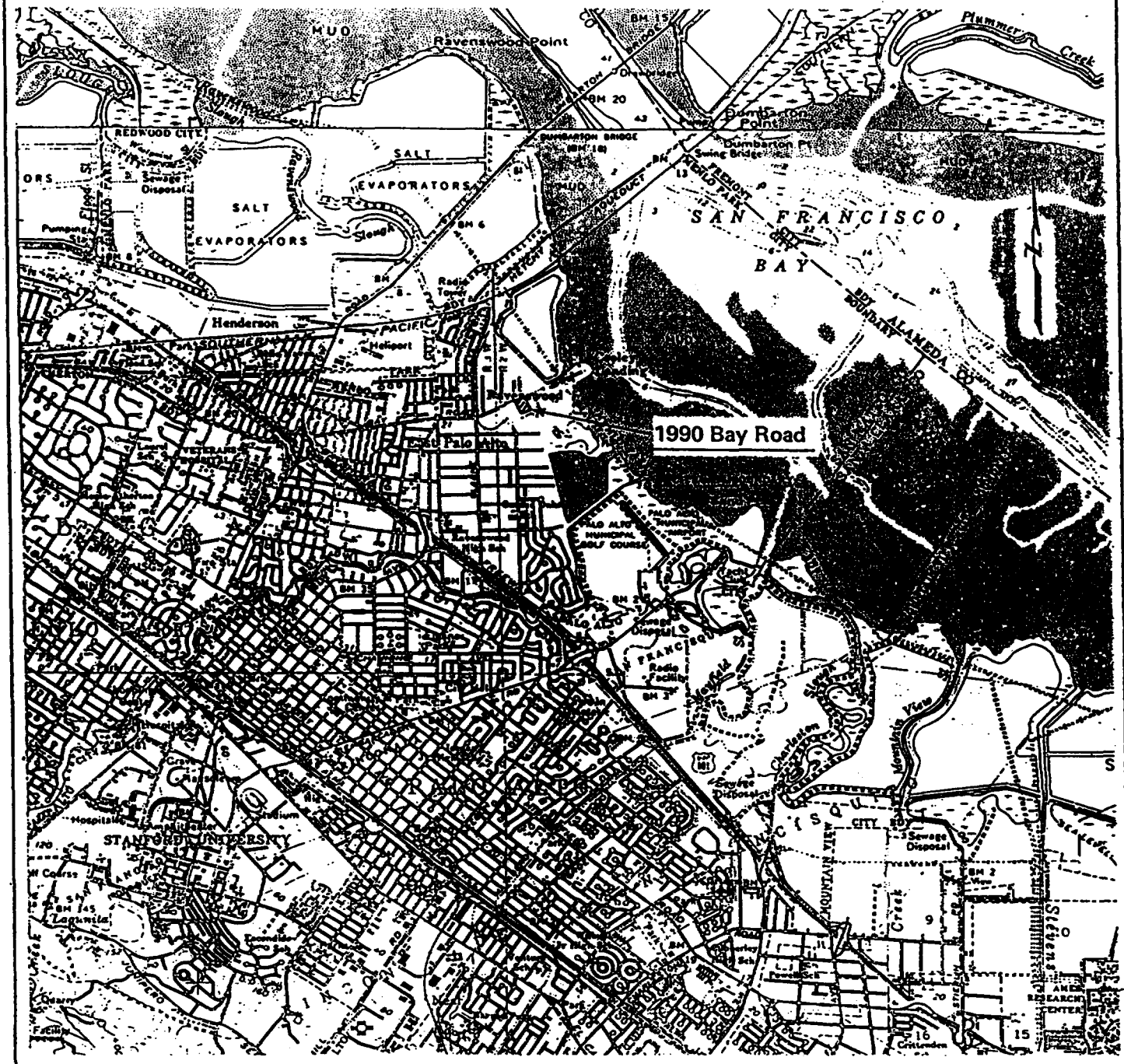
The 3.19 acre Sandoz plant at 1900 Bay Road is developed and the following buildings are on site: office, process, packaging, maintenance/shop, other miscellaneous buildings, and two tank farm areas (Figure 2.2). On a RWQCB underground tank questionnaire submitted by Zoecon in February 1983, the company listed five underground tanks and sumps for the storage of hazardous wastes. The tanks are reportedly used to store aqueous solvent wastes and to contain solvent spills. Hexane, methanol, toluene and n-methyl pyrrolidine are received in bulk and stored in tanks with volumes that range from 5500 - 6000 gallons. Chemicals delivered in metal or plastic drums are stored in an open drum lot which is covered with asphalt and has an accompanying slopage to promote drainage. A railroad spur was located along the southern edge of the plant area at an average elevation of 7 feet. The railroad spur was removed during August 1991.

The former railroad spur extended west and the land is now owned by William and Patricia Bains. This area has been filled to a level grade of approximately 7 feet with gravel.

The area to the south of the site is owned by J.G. Torres Construction Company. This southern area is undeveloped, covers approximately 8 acres, and the northern portion of this area is the location of the former Call-Mac site. Elevations in the northwestern portions of the area range from 3 to 8 feet. Prior to September 1991 the area was covered by high, grassy vegetation. During the rainy season, the eastern portion of the Call-Mac property is submerged. The southeastern corner is hummocky, with elevations varying from 3.5 to 10 feet. The low areas between the hummocks are also submerged during the rainy season.

The Curtaccio property lies immediately to the west of the site and is covered by a concrete slab. The average elevation of this area is 6.5 feet.

The tidal marsh is intermittently submerged throughout the year due to tidal influences. The wetland vegetation and network of tidal channels is part of the Laumeister Tract which is owned by the City of Palo Alto.



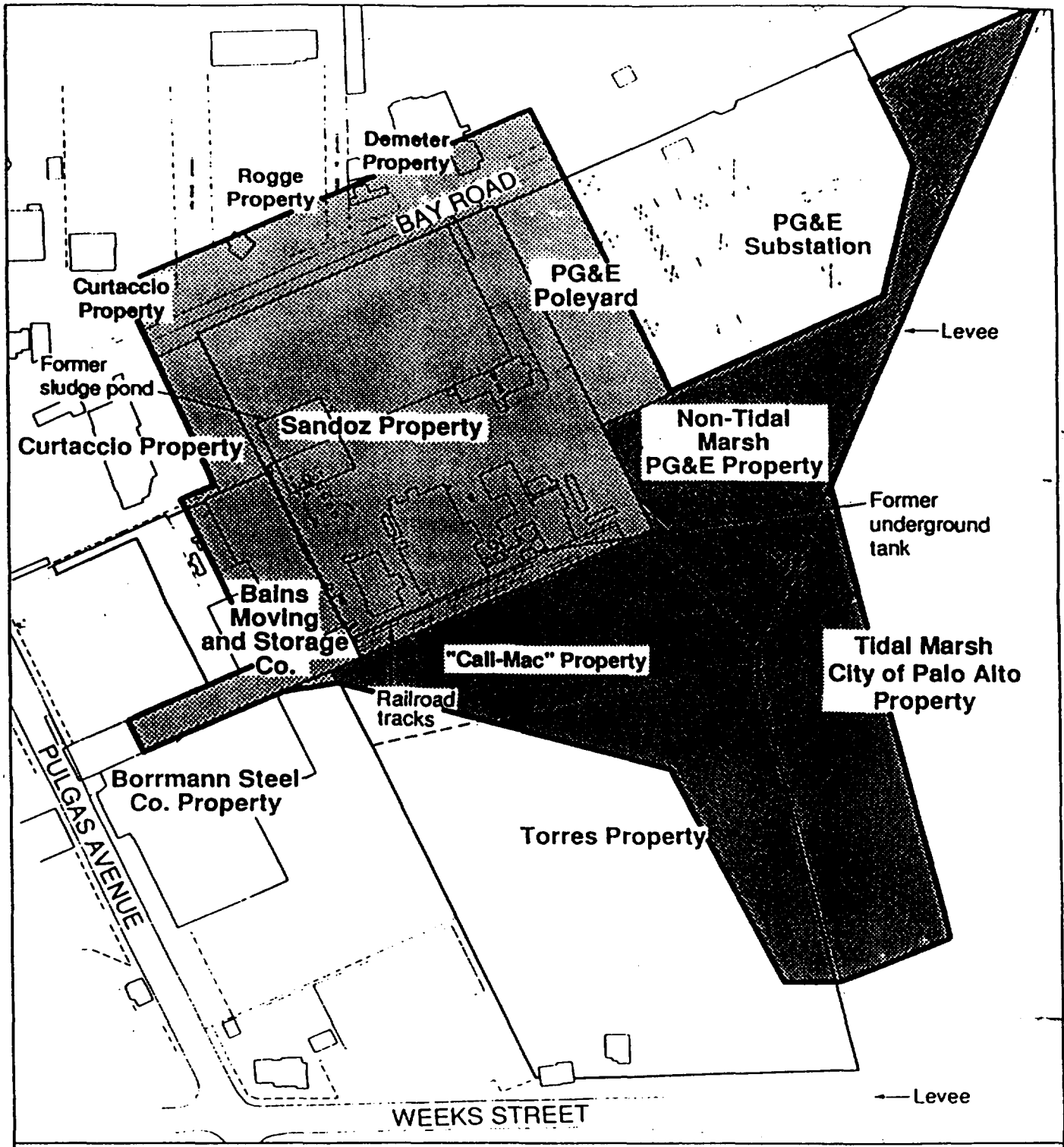
Reference: Palo Alto (1961) and Hayward (1959) Quadrangles, California, 15 minute Series (Topographic), United States Department of the Interior, Geological Survey.

GEOMATRIX

SITE AND VICINITY LOCATION MAP
1990 Bay Road Site and Vicinity
East Palo Alto, California

Figure 1.1

Project No. 1220A-1500



EXPLANATION

- Approximate site boundary
- Upland operable unit
- Wetland operable unit

N

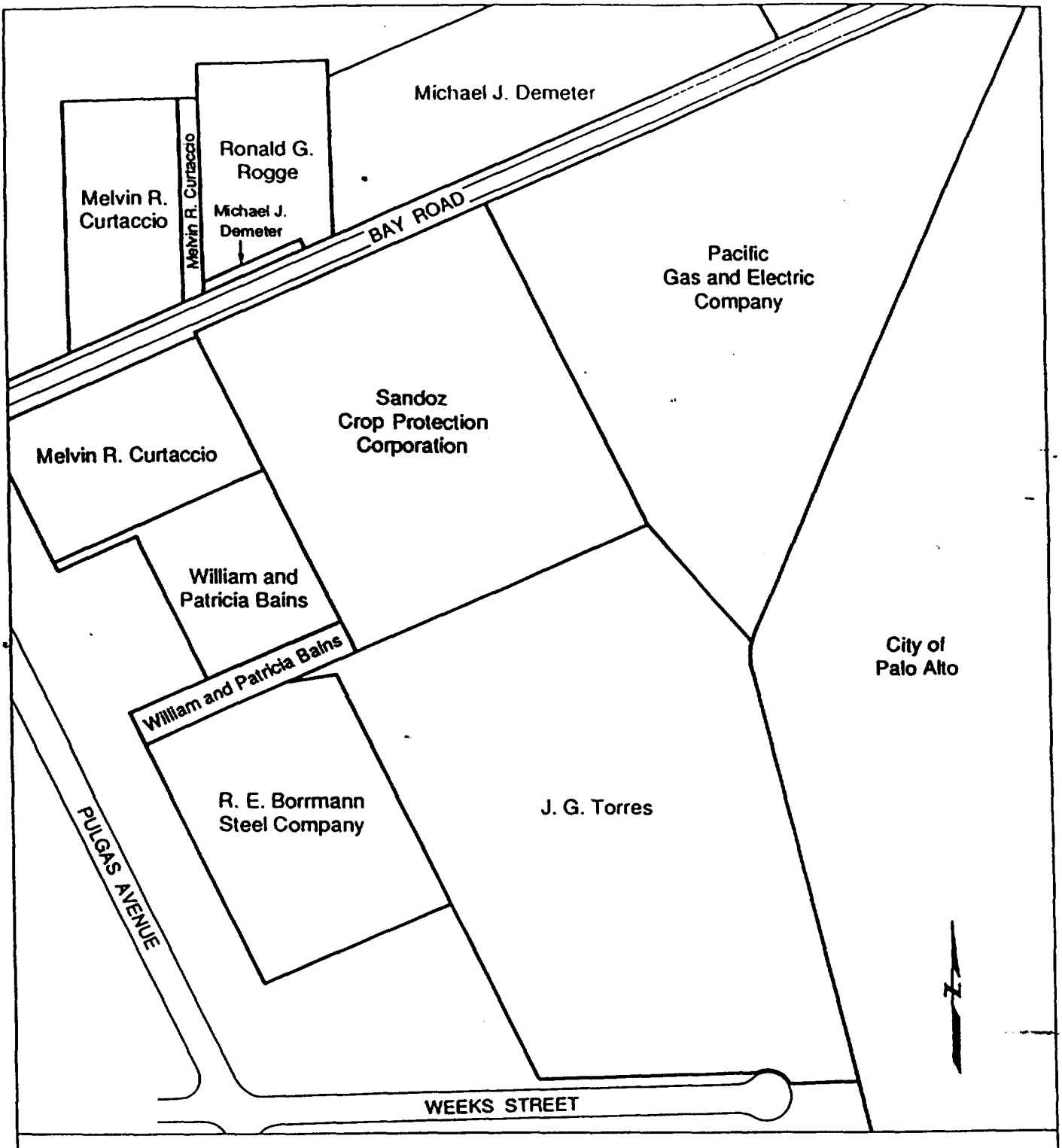
0 200 Feet

GEOMATRIX

SITE AREA DESIGNATIONS
1990 Bay Road Site
East Palo Alto, California

Figure 1.2

Project No 1220F

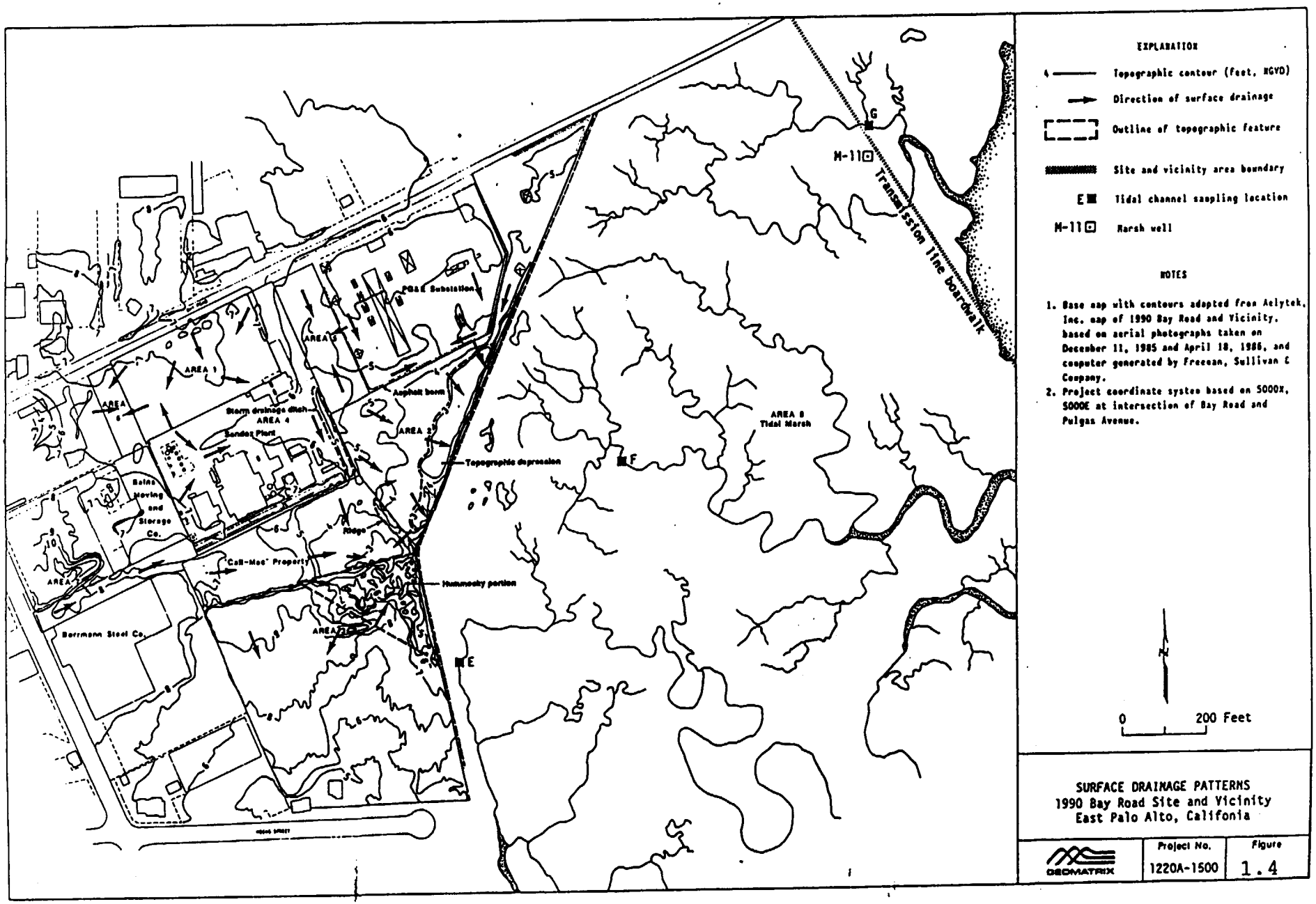


GEOMATRIX

PROPERTY BOUNDARIES
1990 Bay Road Site
East Palo Alto, California

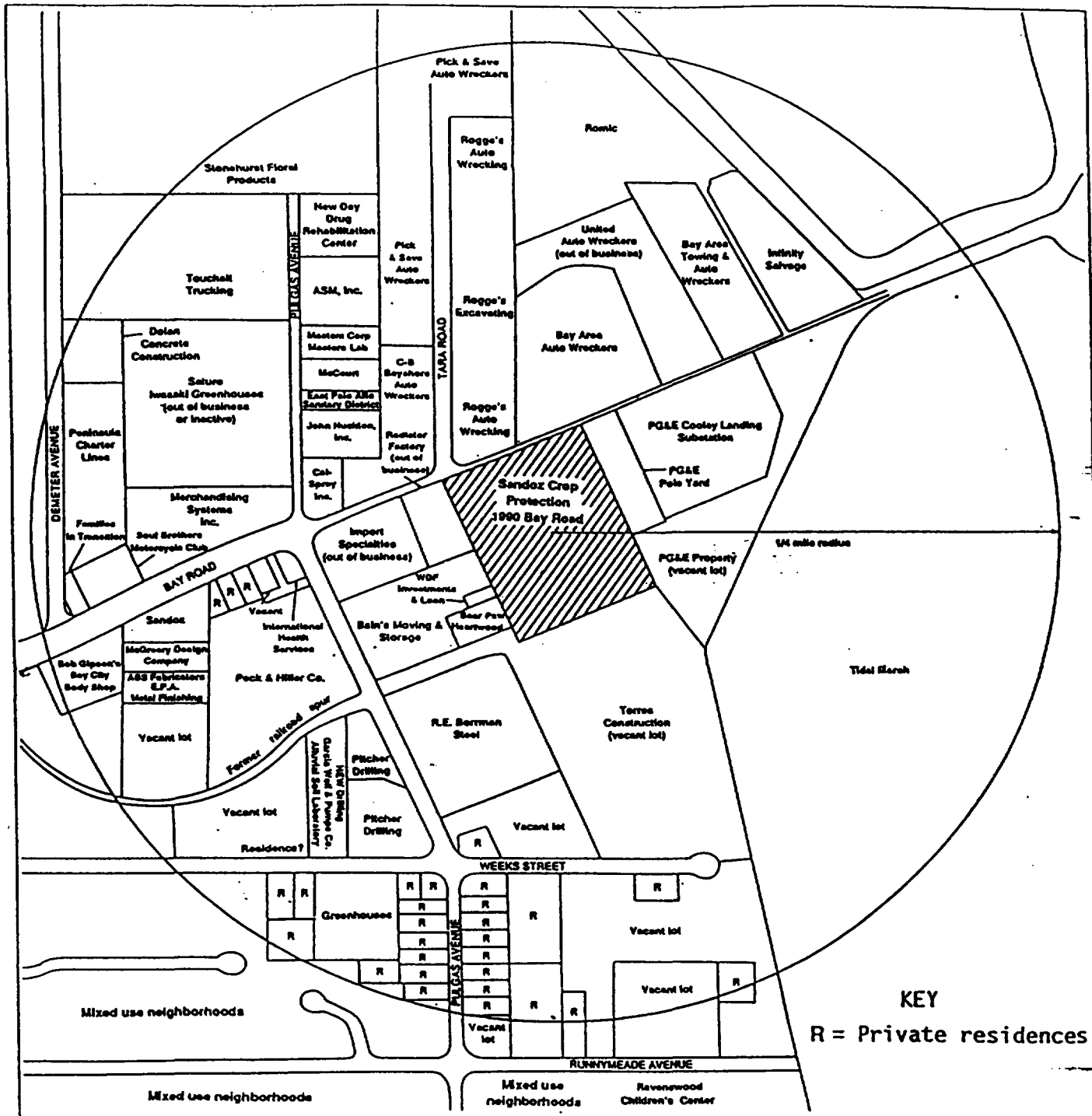
Figure
1.3

Project No.
1220F



SURFACE DRAINAGE PATTERNS
1990 Bay Road Site and Vicinity
East Palo Alto, Califonia

GEOMATRIX	Project No.	Figure
	1220A-1500	1.4



Notes

1. Map of 1990 Bay Road and vicinity based on aerial photographs from Pacific Aerial Photos made on December 11, 1985
2. See Table 12 for number of employees present at the facilities shown based on interviews conducted in October and November 1988.

GEOMATRIX

SURVEY OF BUSINESSES AND RESIDENCES WITHIN A 1/4 MILE RADIUS OF THE 1990 BAY ROAD SITE
East Palo Alto, California

Figure 1.5

Project No. 1220A-1500

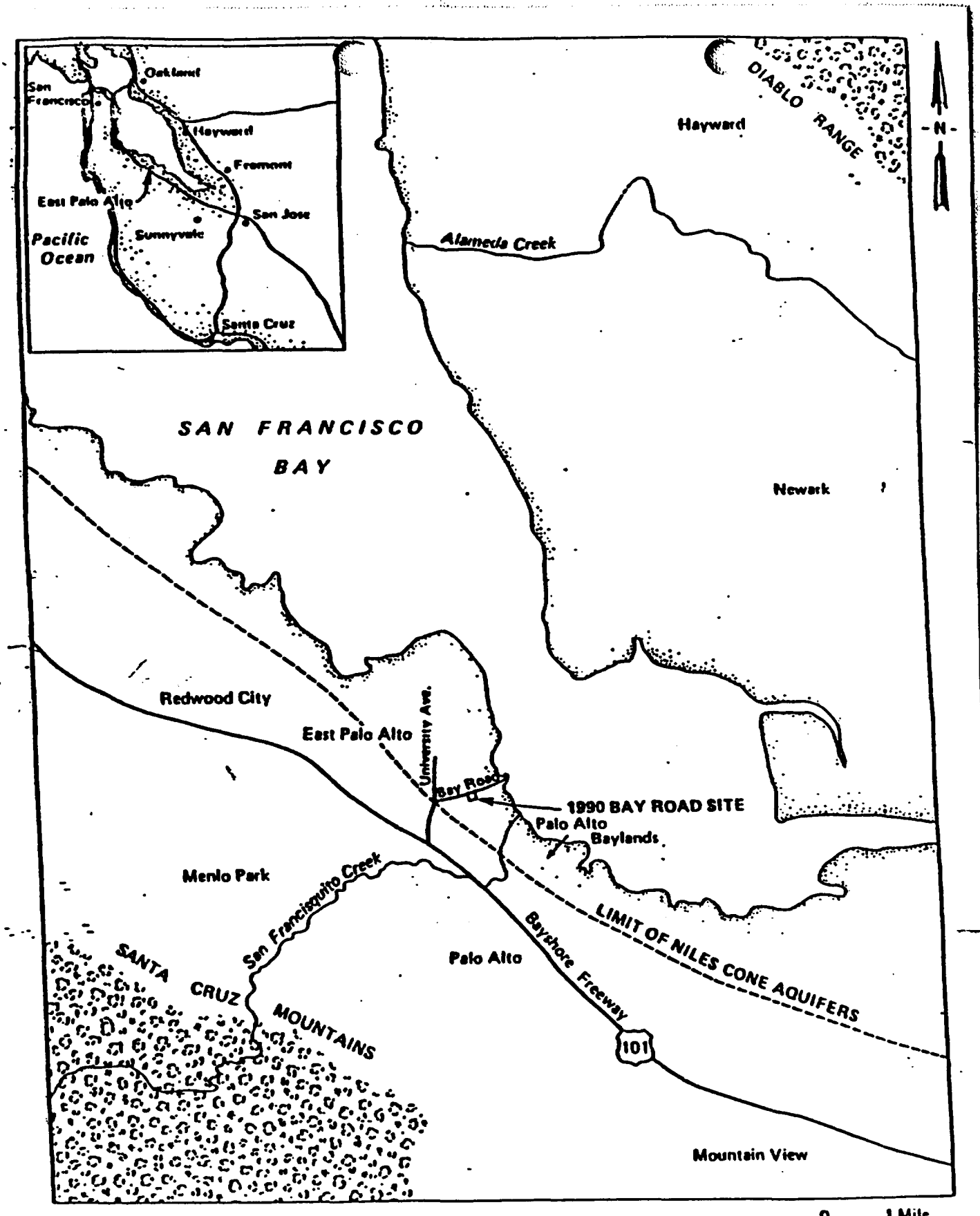


Figure 1-6

LOCATION MAP

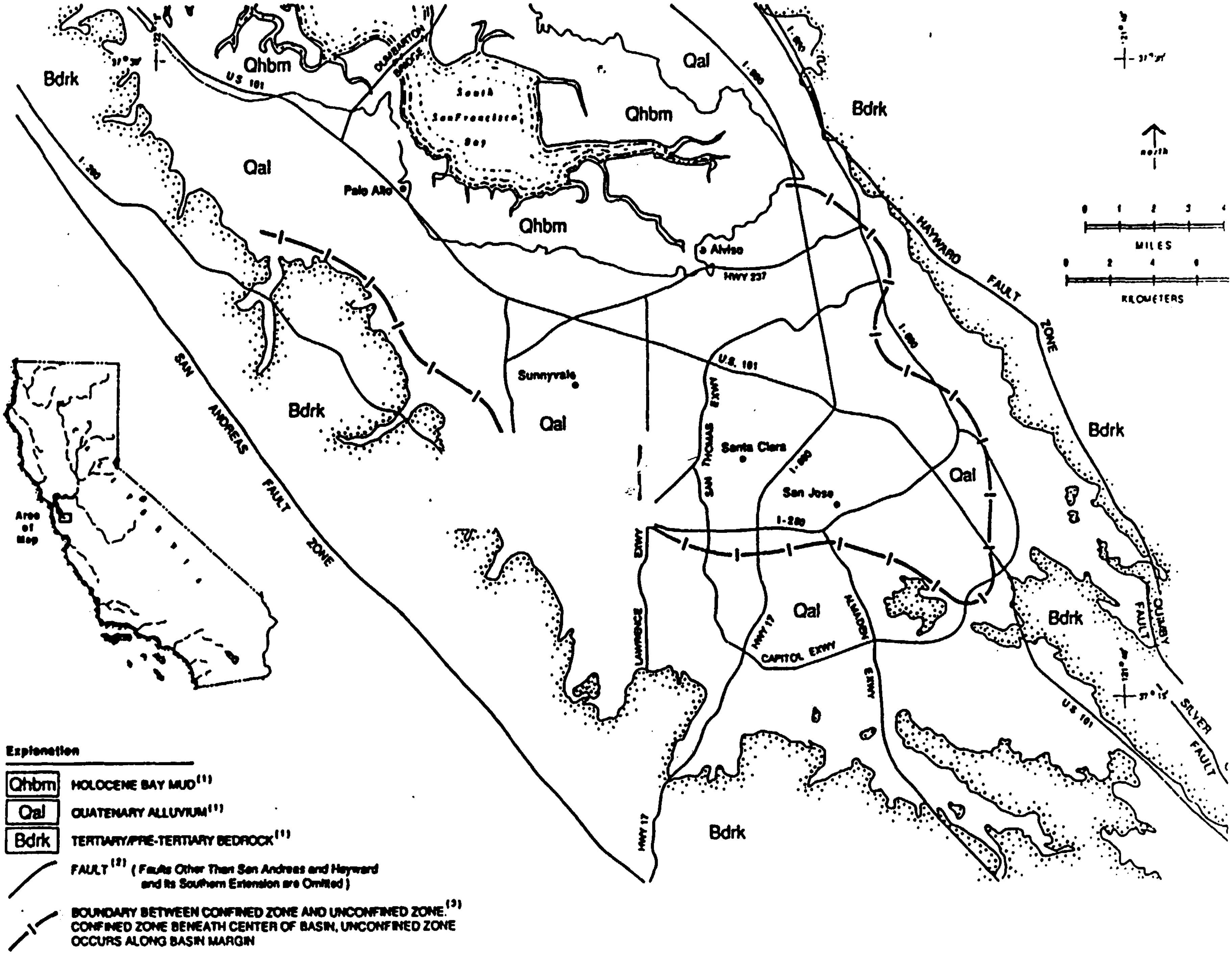
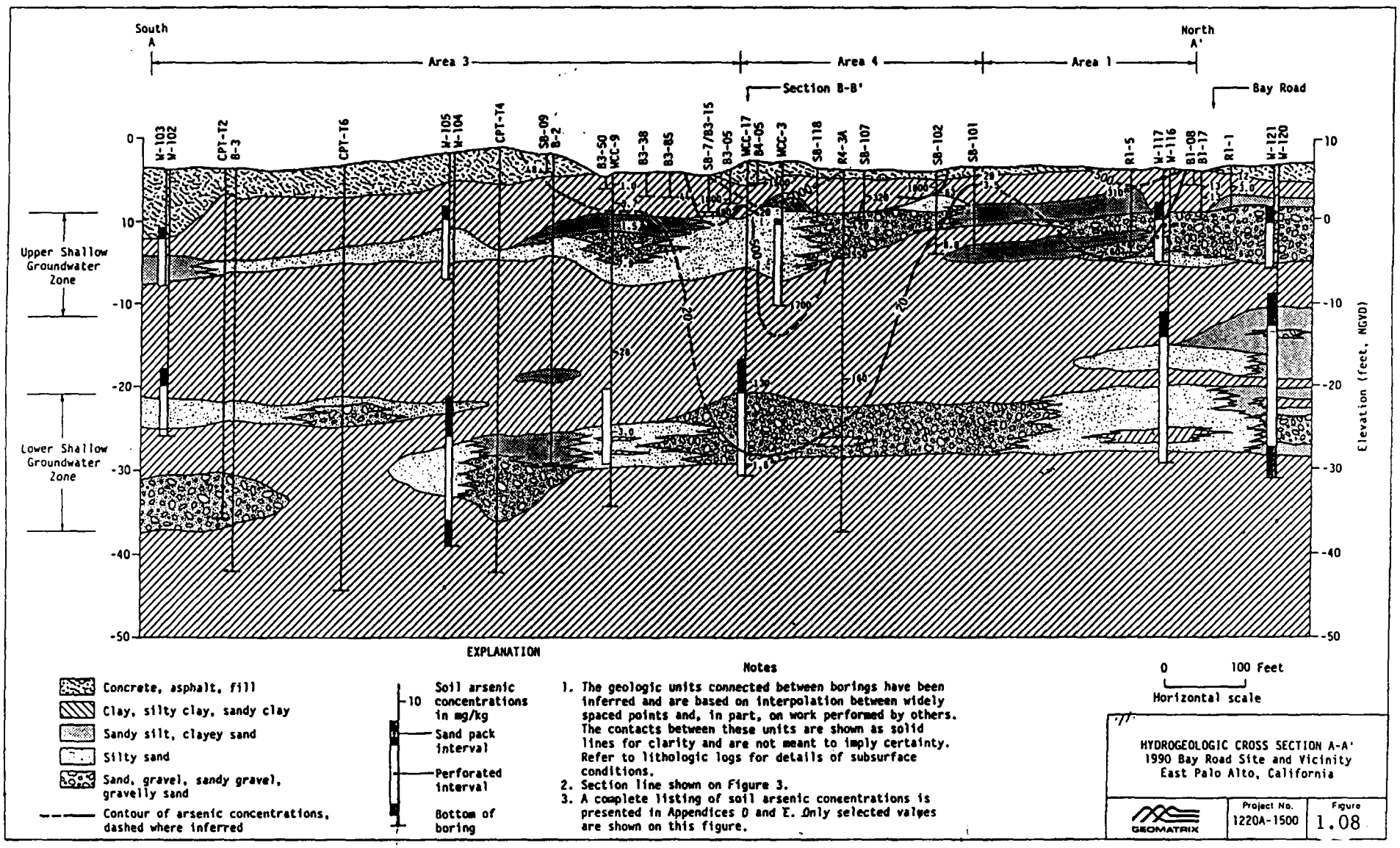
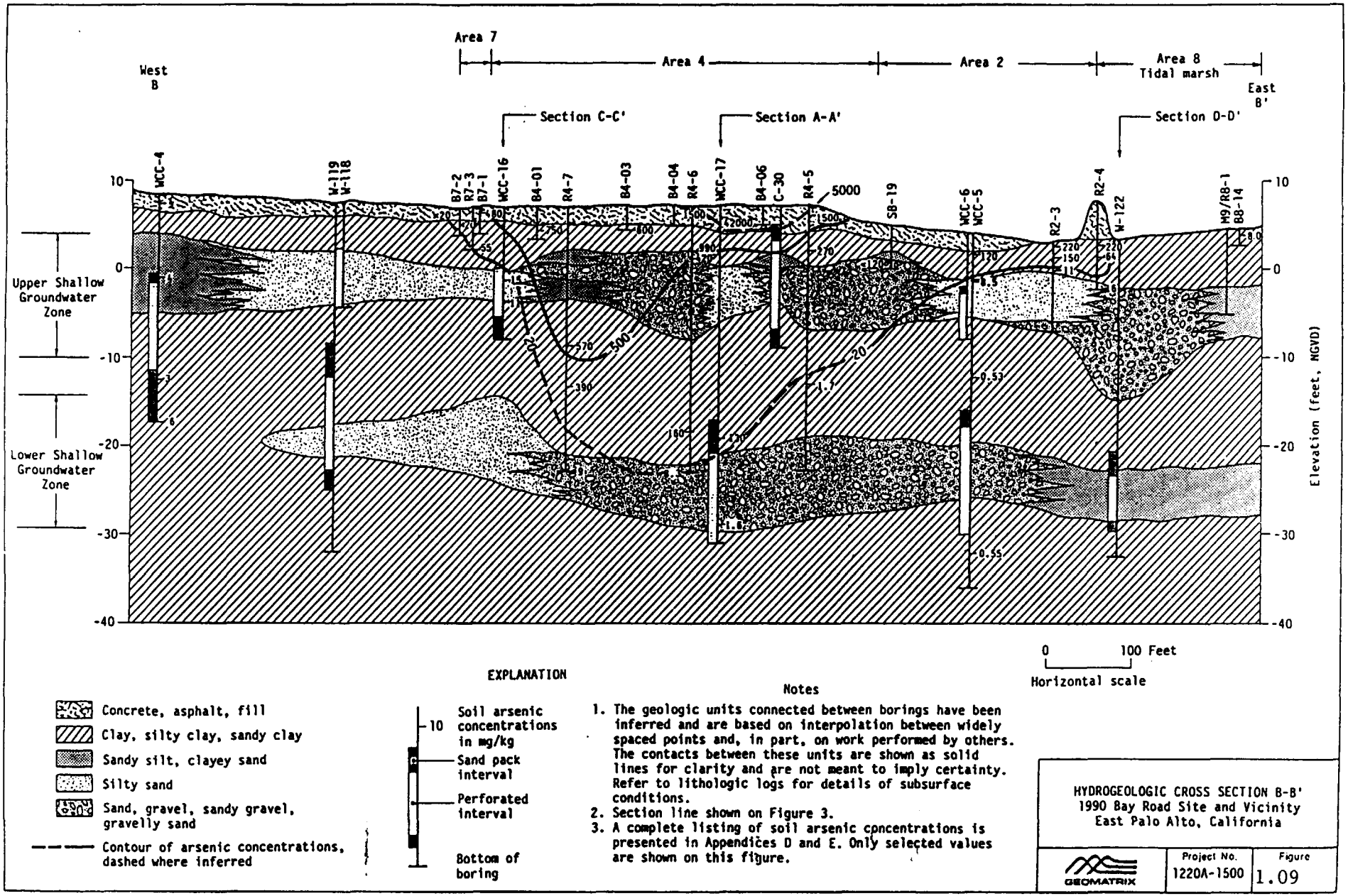
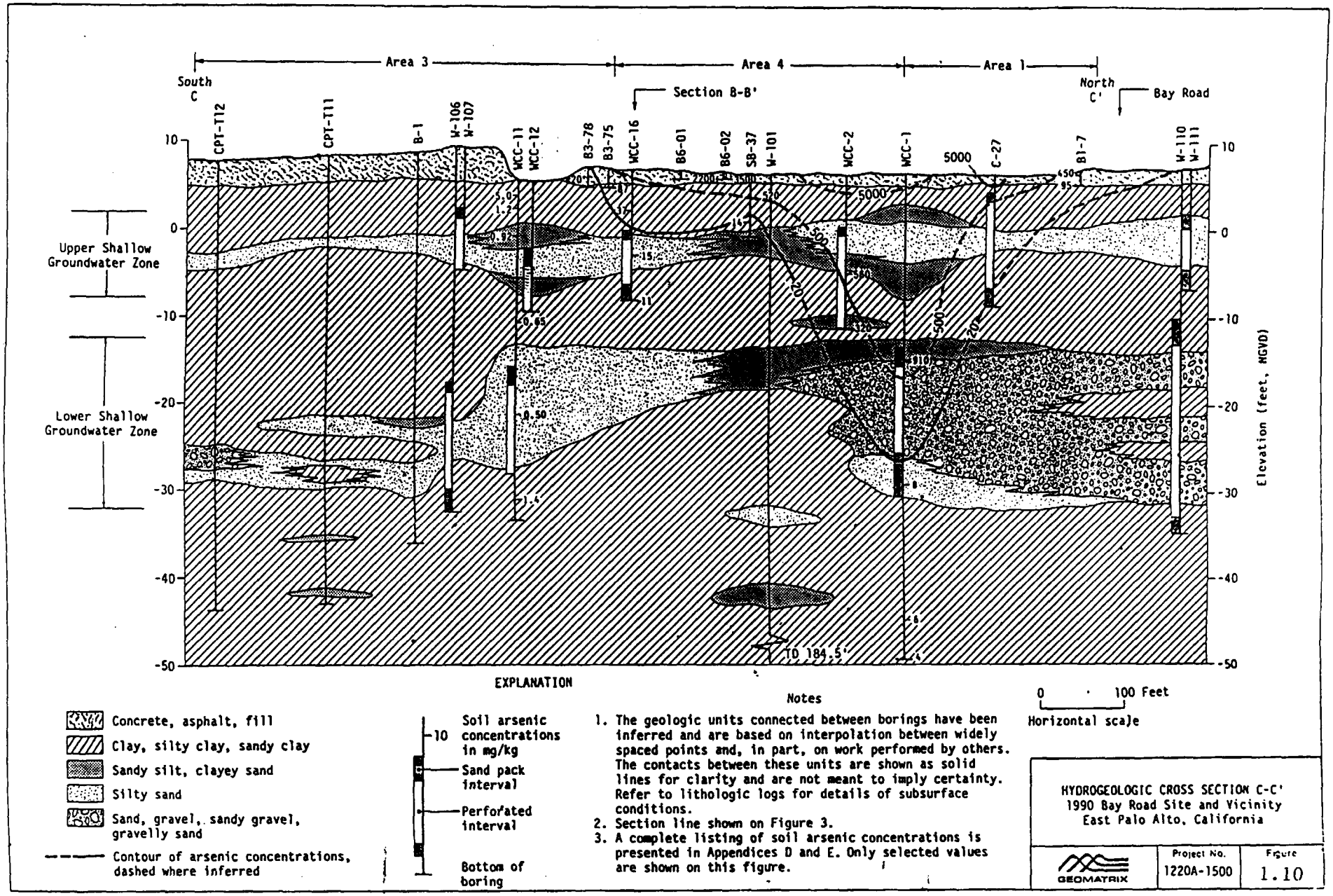
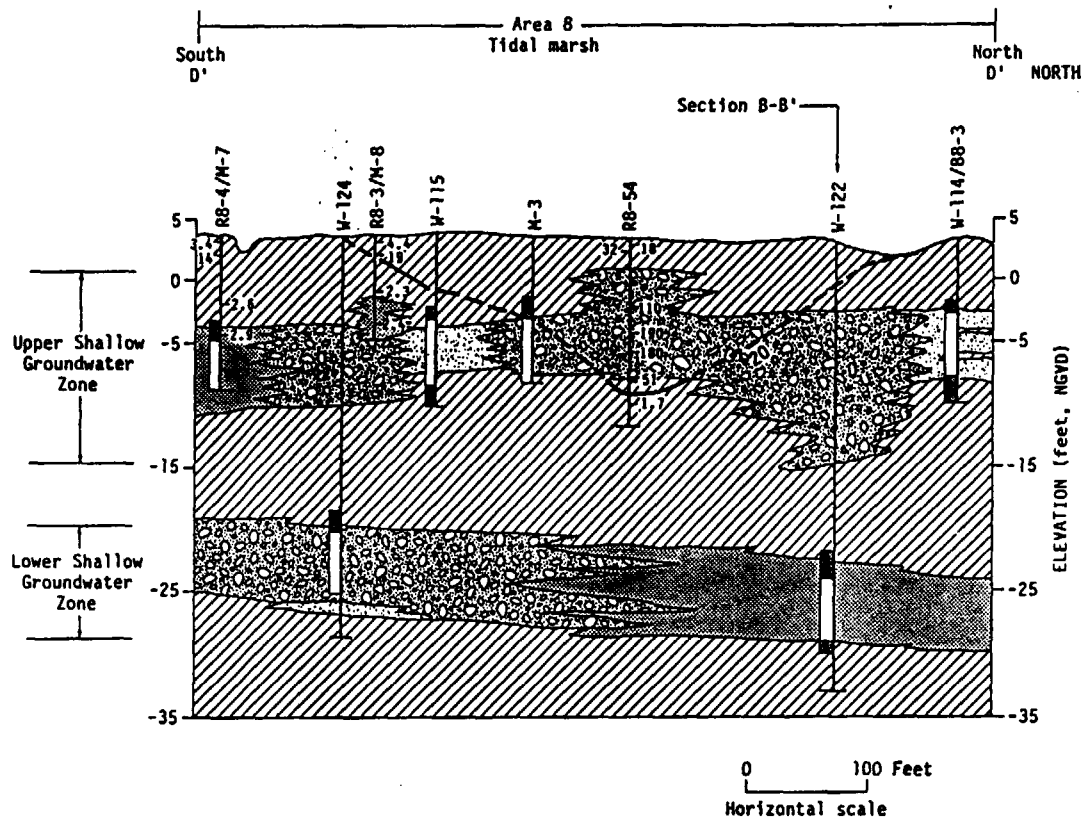

Bdrk
Qhbm
Qal
South San Francisco Bay
Dumbarton Bridge
US 101
I-280
I-880
Palo Alto
Alviso
HWY 237
Sunnyvale
Santa Clara
San Jose
San Tomas Expwy
Lawrence Expwy
HWY 17
Almaden Expwy
Capitol Expwy
San Andreas Fault Zone
Hayward Fault Zone
Silver Creek Fault
Quimby Fault
Area of Map
north
MILES
KILOMETERS
Explanation
Qhbm HOLOCENE BAY MUD(1)
Qal QUATENARY ALLUVIUM(1)
Bdrk TERTIARY/PRE-TERTIARY BEDROCK(1)
FAULT(2) (Faults Other Than San Andreas and Hayward and Its Southern Extension are Omitted)
BOUNDARY BETWEEN CONFINED ZONE AND UNCONFINED ZONE.(3) CONFINED ZONE BENEATH CENTER OF BASIN, UNCONFINED ZONE OCCURS ALONG BASIN MARGIN

Figure 1-7


South
A
North
A'
Area 3
Area 4
Area 1
Section B-B'
Bay Road
Upper Shallow Groundwater Zone
Lower Shallow Groundwater Zone
Elevation (feet, NGVD)
EXPLANATION
Concrete, asphalt, fill
Clay, silty clay, sandy clay
Sandy silt, clayey sand
Silty sand
Sand, gravel, sandy gravel, gravelly sand
Contour of arsenic concentrations, dashed where inferred
Soil arsenic concentrations in mg/kg
Sand pack interval
Perforated interval
Bottom of boring
Notes
1. The geologic units connected between borings have been inferred and are based on interpolation between widely spaced points and, in part, on work performed by others. The contacts between these units are shown as solid lines for clarity and are not meant to imply certainty. Refer to lithologic logs for details of subsurface conditions.
2. Section line shown on Figure 3.
3. A complete listing of soil arsenic concentrations is presented in Appendices D and E. Only selected values are shown on this figure.
0
100 Feet
Horizontal scale
HYDROGEOLOGIC CROSS SECTION A-A'
1990 Bay Road Site and Vicinity
East Palo Alto, California
GEOMATRIX
Project No.
1220A-1500
Figure
1.08


Area 7
Area 4
Area 2
Area 8
Tidal marsh
West
B
East
B'
Section C-C'
Section A-A'
Section D-D'
WCC-4
W-119
W-118
B7-2
B7-3
B7-1
WCC-16
B4-01
R4-7
B4-03
B4-04
R4-6
WCC-17
B4-06
C-30
R4-5
SB-19
WCC-6
WCC-5
R2-3
R2-4
W-122
M9/R8-1
B8-14
Upper Shallow Groundwater Zone
Lower Shallow Groundwater Zone
10
0
-10
-20
-30
-40
Elevation (feet, NGVD)
0
100 Feet
Horizontal scale
EXPLANATION
Concrete, asphalt, fill
Clay, silty clay, sandy clay
Sandy silt, clayey sand
Silty sand
Sand, gravel, sandy gravel, gravelly sand
Contour of arsenic concentrations, dashed where inferred
10
Soil arsenic concentrations in mg/kg
Sand pack interval
Perforated interval
Bottom of boring
Notes
1. The geologic units connected between borings have been inferred and are based on interpolation between widely spaced points and, in part, on work performed by others. The contacts between these units are shown as solid lines for clarity and are not meant to imply certainty. Refer to lithologic logs for details of subsurface conditions.
2. Section line shown on Figure 3.
3. A complete listing of soil arsenic concentrations is presented in Appendices D and E. Only selected values are shown on this figure.
HYDROGEOLOGIC CROSS SECTION B-B'
1990 Bay Road Site and Vicinity
East Palo Alto, California
GEOMATRIX
Project No.
1220A-1500
Figure
1.09


Area 3
Area 4
Area 1
South C
North C'
Section B-B'
Bay Road
CPT-T12
CPT-T11
B-1
W-106
W-107
WCC-11
WCC-12
B3-78
B3-75
WCC-16
B6-01
B6-02
SB-37
W-101
WCC-2
WCC-1
5000
C-27
B1-7
W-110
W-111
Upper Shallow Groundwater Zone
Lower Shallow Groundwater Zone
Elevation (feet, NGVD)
TD 184.5'
EXPLANATION
Concrete, asphalt, fill
Clay, silty clay, sandy clay
Sandy silt, clayey sand
Silty sand
Sand, gravel, sandy gravel, gravelly sand
Contour of arsenic concentrations, dashed where inferred
Soil arsenic concentrations in mg/kg
Sand pack interval
Perforated interval
Bottom of boring
Notes
1. The geologic units connected between borings have been inferred and are based on interpolation between widely spaced points and, in part, on work performed by others. The contacts between these units are shown as solid lines for clarity and are not meant to imply certainty. Refer to lithologic logs for details of subsurface conditions.
2. Section line shown on Figure 3.
3. A complete listing of soil arsenic concentrations is presented in Appendices D and E. Only selected values are shown on this figure.
0 100 Feet
Horizontal scale
HYDROGEOLOGIC CROSS SECTION C-C'
1990 Bay Road Site and Vicinity
East Palo Alto, California
GEOMATRIX
Project No. 1220A-1500
Figure 1.10



EXPLANATION

- Clay, silty clay, sandy clay
- Sandy silt, clayey sand
- Silty sand
- Sand, gravel, sandy gravel, gravelly sand
- Contour of arsenic concentrations, dashed where inferred

10 Soil arsenic concentrations in mg/kg

Sand pack interval

Perforated interval

Bottom of boring

Notes

1. The geologic units connected between borings have been inferred and are based on interpolation between widely spaced points and, in part, on work performed by others. The contacts between these units are shown as solid lines for clarity and are not meant to imply certainty. Refer to lithologic logs for details of subsurface conditions.
2. Section line shown on Figure 3.
3. A complete listing of soil arsenic concentrations is presented in Appendices D and E. Only selected values are shown on this figure.

HYDROGEOLOGIC CROSS SECTION D-D'
1990 Bay Road Site and Vicinity
East Palo Alto, California

GEOMATRIX | Project No. 1220A-1500 | Figure 1.11

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 HISTORY OF SITE OWNERSHIP

Prior to 1926	The site was occupied by Reed Zinc Company.
1926	Chipman Chemical Engineering Company began using the site for production of herbicides.
January 12, 1932	Chipman Chemical Engineering Company changed its name to Chipman Chemical Company.
1926 until 1967	The site was operated by the Chipman Chemical Company.
December 6, 1967	Rhodia, Inc. merged with Chipman and became Rhodia, Inc., Chipman Division.
1971	Rhodia Inc., Chipman Division, closed its East Palo Alto plant.
June 7, 1972	Rhodia, Inc., successor by merger to Chipman Chemical Company, sold the site to Zoecon Corporation. Zoecon was incorporated in Delaware in 1968.
August 1977	Occidential Petroleum Corporation aquired Zoecon Corporation. The 1978 edition of Moody's reported that Zoecon would operate as a subsidiary of Hooker Chemical Corporation.
October 20, 1978	Rhodia, Inc changed its corporate name to Rhone-Poulenc, Inc. The 1984 edition of Moody's Industrial Manual lists Rhone Poulenc, Inc., as the United States subsidiary of Rhone-Poulenc S.A. established in France in 1895. Rhone-Poulenc S.A. maintains a worldwide network of sales offices and production subsidiaries for agrochemicals, communication products, textiles, basic and speciality chemicals, and pharmaceuticals.
1981	Zoecon described its business at the 1990 Bay Road address as the manufacture of biorational insect control agents. Products manufactured included methoprene, kinoprene, tricosene, and adhesives for cockroach traps.
April 5, 1983	Sandoz United States Inc. purchased Zoecon Corporation from Occidential. Sandoz United States, Inc. is an American subsidiary of Sandoz, Ltd., which was incorporated in Switerland in 1895.
June 1, 1986	Zoecon merged with Velsicol Corporation to form Sandoz Crop Protection Company.

2.2 HISTORY OF CONTAMINATION

Chipman was responsible for the formulation of agricultural pesticides, railroad right-of-way herbicides, insecticides, and arsenic-based products between 1926 and 1964. Herbicide manufacturing conducted on the site by Chipman and Rhodia involved the use of arsenic and other heavy metals. Chipman Company correspondence and product labels, show that Chipman was handling arsenic at the site as early as 1929.

In 1929, Chipman was sued by the owner of the adjoining property concerning contamination of his land with arsenic. The farmer specifically alleged that Chipman's carelessness had caused arsenious substances to be deposited onto his land, contaminating his alfalfa, and causing his cattle to sicken.

In response to this suit, Chipman began to lease a one acre parcel of land from the farmer in order to keep cattle from grazing in an area contaminated with arsenic. In a 1938 interoffice letter from W. H. Moyer to R. N. Chipman, which discussed the lease, the author discussed the possibility of buying the one acre parcel from the farmer. He mentioned the farmer's claim that arsenic had blown onto the land, and stated that "if there was ever residential or industrial development on the property, that there could be considerable difficulty due to Chipman's handling of arsenic in bulk".

Zoecon obtained labels from various Chipman products which contained registration dates from 1968 to 1972. These labels show that Rhodia, Inc., Chipman Division manufactured the following herbicidal products during those years :

Product	Arsenic Ingredient
Atlas "A"	44.0 % sodium arsenite
Atlas "A" 6	57.4 % sodium arsenite
Chipman Calcium Arsenate	70.0 % tricalcium arsenite
Chip-cal Granular	48.0 % tricalcium arsenate
Chipman Hi-Test Lead Arsenate	98.0 % lead arsenate
Chipman Hi-Test Lead Arsenate	90.5 % lead arsenate

A former Chipman employee testified in a 1982 deposition that these products were stored, repackaged, and distributed at the East Palo Alto facility from 1959 until 1971. This same employee testified that Chipman manufactured herbicides at the East Palo Alto plant, and also received products from a Chipman plant in Portland, Oregon, and repackaged these products from 50 or 30 gallon drums, to 5 gallon or smaller containers. The employee also reported that if liquid materials or herbicides were spilled on the plant floor during manufacturing or breakdown operations, the chemicals would be washed out the door of the building and onto the plant grounds. The material reportedly flowed into a ditch that cut across the property and then flowed onto the adjoining property. The employee further stated that dry material spilled on the plant floor would be swept into drums. These drums would be loaded onto a truck, and the waste in the drums would be dispersed over the property. Herbicide drums which were damaged would be dumped into a man made pond on the property. Incorrectly mixed batches of herbicide also would be dumped into this pond.

Arsenic raw material was delivered to the facility by rail or by truck. Southern Pacific shipped arsenic in hopper cars to Chipman's East Palo Alto plant. The hopper cars would be un-

loaded directly into a 50,000 gallon underground tank located beside the railroad track. Arsenic that spilled during this transfer would be washed down into the rocky bed of the track.

Chipman formulated an herbicide product in this underground tank, for Southern Pacific Railroad as an herbicide to kill vegetation along its railroad right-of-ways. A study prepared for Rhone-Poulenc by Woodward-Clyde Consultants determined that this herbicide was a sodium arsenite compound formulated by mixing arsenic trioxide with sodium hydroxide in the underground tank. This herbicide would be pumped from the underground tank into railroad spray cars. Herbicide material spilled during this transfer also would be washed into the rocky fill of the track. Table 2.1 shows an estimate of materials formulated at the site during 1967.

In 1980, as part of a corporate and company-wide policy, Zoecon conducted a preliminary environmental assessment of the Bay Road facility. Soil and groundwater samples revealed that the site was heavily contaminated with arsenic.

CALL-MAC PROPERTY

The Call-Mac site is currently owned by J. G. Torres and is located within the boundaries of the Rhone Poulenc site. This area was used by Call Mac Transportation for storing of drummed hazardous wastes for twenty to thirty years. In January 1981, approximately 1,300 drums was counted on site. According to the labels, the drums contained allyl alcohol, phosphorus trichloride, isopentane kerosene, benzoyl chloride, acrolein, diethylene triamine, triethylene tetramine, and tetraethylene pentamine.

The material on the easterly portion of the Call-Mac site was determined to have originated from the Shell Development Company research laboratories in Emeryville, California in the late 1950's and early 1960s. The material on the westerly portion of the site was determined to have originated from the Diamond Shamrock Corporation plant in Redwood City, California in the late 1960s and early 1970s.

The drums and approximately 25 cubic yards of soils was removed from the site by Chemical Waste Management, Inc of Kettleman City, California and International Technologies Corporation of Benicia, California between March 10 and July 29th of 1981. Confirmation samples taken on September 16th 1981 determined the following:

(1) the major contaminant on the property was arsenic soils that resulted from Chipman's activities;

(2) the only soil contamination remaining from the Call-Mac operations was an area contaminated with triethylene tetramine that leaked from drums of waste obtained from the Diamond Shamrock Corporation;
(3) the organic amine contamination was much less widespread and less significant than the arsenic contamination.

EPA conducted a preliminary assessment review of the Call-Mac property during September of 1989. The preliminary assessment determined that the site was not eligible for inclusion on the National Priorities List.

2.3 HISTORY OF ENFORCEMENT ACTIONS

This site was proposed for inclusion on the National Priorities List on October 15, 1984 (49 FR 40320) and then became subject to regulation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. The California Department of Health Services (DOHS) was the lead agency in regulation of CERCLA/SARA pursuant to a DOHS Consent Order dated August 27, 1987, and signed by Rhone Poulenc, DOHS and the Board.

On June 10, 1986, EPA announced a policy to list RCRA Subtitle C facilities on the NPL only if they meet the final RCRA listing criteria (51 FR 21054). These criteria are: 1) bankruptcy; 2) loss of authorization to operate/probable unwillingness to carry out corrective action; and 3) case-be-case determinations of unwillingness. As a result of the criteria listed above EPA decided to drop sites proposed for the NPL that did not meet the above criteria. It is important to note that the only authority available at a RCRA drop site is the use of CERCLA Trust Fund monies for remedial actions. In October, 1989, the site was removed from consideration for the NPL by EPA. Sandoz Crop Protection Corporation is a RCRA facility which treats and stores hazardous wastes under Department of Health Services (DOHS) Permit CAT00061135.

Under the EPA's RCRA deferral policy, regulation of the site cleanup continued under DOHS lead pursuant to their 1987 Consent Order and followed CERCLA guidance, until lead agency status was changed in 1991. The parties vacated all provisions of the Consent Order by stipulation in February 1991, except for those referencing the state's ability to seek cost recovery. Pursuant to the South Bay Multi-Site Cooperative Agreement (MSCA) and the South Bay Ground Water Contamination Enforcement Agreement, entered into on May 2, 1985 (as subsequently amended) by the Regional Water Quality Control Board ("the Board" or "RWQCB"), EPA and the California Department of Health Services (DHS), the

Board has been acting as the lead agency for the site since January, 1991. The site is currently being regulated under RWQCB orders.

Responsible Party Determination

The RWQCB has named Rhone Poulenc and Sandoz Crop Protection Corporation as dischargers under California Health and Safety Code Sections 25356.1 (c) and (d). EPA completed a PRP Search on June 27, 1985. This search identified Rhone-Poulenc, Inc as a potentially responsible party for the contamination at the 1990 Bay Road facility due to its previous ownership of the property, and the arsenic handling and disposal practices conducted by its predecessor companies. The current owner and operator of the site, Sandoz Crop Protection Corporation has also been identified as a potentially responsible party due to its ownership of the property.

Agreements Among Responsible Parties

In January 1982, Zoecon filed a lawsuit in San Mateo Superior court against Rhone-Poulenc, its predecessors, and Southern Pacific Transportation Company. In February 1986, Rhone Poulenc and Zoecon entered into an Agreement of Release and Indemnification agreement. Rhone Poulenc has been overseeing all site cleanup activities.

Enforcement History

A draft Remedial Action Plan dated July 31, 1986 was reviewed by EPA and in a September 1, 1986 letter EPA stated that "the RAP, which was prepared by Rhone-Poulenc, does not meet the intent of the National Contingency Plan and CERCLA guidance for Remedial Investigations and Feasibility Studies (RI/FS)". EPA cited four major concerns with the July 1986 Remedial Action Plan. One concern was that the remaining levels of arsenic proposed to be left on site and the vicinity would exceed the designated RCRA hazardous waste level and that the contamination at the site had not been adequately characterized by the Remedial Investigation. Three major concerns with the Feasibility Study were also cited. They included completion of an exposure assessment pursuant to CERCLA guidance, evaluating a full range of cleanup alternatives, and the evaluation of each alternative was not adequate. Based on this information the remedial investigation was reopened. In August 1989 Rhone Poulenc submitted a second Feasibility Study. Review of this document by EPA and U.S. Fish and Wildlife Service determined that the Remedial Investigation for the site had not completely addressed wetland issues. EPA and U.S. Fish & Wildlife Service made the determination that Rhone Poulenc needed to perform a ecological assessment for the site before the agencies could determine whether or not

the wetlands at the site had been impacted by site activities and subsequently evaluate remedial alternatives for cleanup of the wetlands.

After the agency lead for the site was switched from California Department of Health Services to the California Regional Water Quality Control Board, the site was also divided into two operable units (Wetland OU and Upland OU). A workplan for the ecological assessment was submitted on May 14, 1990.

The following is a chronology of important Rhone Poulenc regulatory activities.

1. Regional Board adopted Cleanup and Abatement Order No. 82-001 on April 15, 1982, requiring the dischargers to determine the lateral and vertical extent of heavy metals and organic compounds in the soil and groundwater both on and off-site. Subsequent revisions of the Order were made to allow additional time for completion of tasks; Order 82-002 adopted on April 21, 1982, Order 82-005 adopted on October 13, 1982, and Order 83-012 adopted on December 20, 1983.

2. Regional Board Order 85-67 was adopted on May 15, 1985. The Order required installation of a monitoring well network in the shallow and deep aquifers and submit results of groundwater sample analyses.

3. Regional Order 87-052 issued 5/20/87. Order Setting Amended Administrative Civil Liability Order No. 87-001. Issued due to failure of Rhone Poulenc to install monitoring wells and submit sample results according to the schedule in Board Order No. 85-67. Administrative civil liability payment in the amount of $25,000 was paid.

4. Department of Health Services Consent Order dated August 27, 1987, and signed by Rhone Poulenc, DOHS and the Board.

5. RWQCB Site Cleanup Requirements Order No. 91-016, adopted February 20, 1991 (rescinding and replacing existing order to reflect change in lead agency, to include tasks necessary to complete the FS/RAP process, to update groundwater monitoring and to ensure design of an adequate groundwater mitigation response for final site cleanup).

6. RWQCB Site Cleanup Requirements Order No. 91-095 adopted June 19, 1991 (amending Order No. 91-016) to add provisions for implementing an Early Action Removal Plan (EARP).

2.3 HISTORY OF SITE ACTIVITIES

Interim Remedial Actions

In 1981, under direction of DTSC (then DOHS), drummed waste and associated contaminated soil unrelated to Rhone Poulenc/ (Zoecon) Sandoz (RP/ZS) were removed by Shell Development Company and Diamond Shamrock from the northern portion of the Torres property (see Figure 2, Call-Mac Property). Interim actions at the site have included monitoring of groundwater in the shallow and deep groundwater zones with a monitoring well network installed under Board Order 85-67. In March 1987, pursuant to an order issued by DTSC, RP/ZS installed a fence around certain areas of the site corresponding to the approximate 50 mg/kg soil arsenic concentration and posted warning signs.

On April 30, 1991 RP/ZS submitted an Early Action Removal Plan presenting technical documentation and construction methodology for conducting excavation of soils with high concentrations of arsenic. Extensive soil sampling was conducted during June and July 1991. On August 15th, RP/ZS submitted a Pre-excavation Sampling Report and a more detailed Construction Plan for the 1991 removal. During August 1991 RP/ZS completed several pre-excavation activities which consisted of the following:

1. Removal and disposal of wooden railroad ties in the former track area as a hazardous waste;

2. Removal of approximately 2000 lineal feet of buried pipelines, four steel boxes, and one concrete and steel hopper located in the former railroad track area;

3. Removal and rerouting of a 120 foot long section of 3-inch diameter steel water-supply pipe located above ground to the Sandoz plant

The Early Action Removal completed in September, 1991 involved the removal of soils containing concentrations of arsenic greater than 5000 mg/kg from the undeveloped portion of the Sandoz property and the northern portion of the Torres property. Approximately 5900 tons (4000 yd^3, 268 truck loads) of soil was excavated and disposed of offsite at a Class I facility in accordance with state and federal land disposal regulations. This was accomplished in accordance with the Early Action Removal Plan approved by Regional Board Order Amendment 91-095.

Table 2.1

ESTIMATE OF MATERIALS FORMULATED AT 1990 BAY ROAD IN 1967
1990 Bay Road Site

Material	Active Ingredients[1]	Powder or Liquid[2]	Ranking by Volume[2]	Volume[2]	Location of Formulation[3]	Storage Location[3]	Packaging Containers
Chlorax 40 & Shed-A-Leaf	sodium chlorate (40%) sodium metaborate (60%)	Powder	2	422,280 lb	Bdg M	Warehouse O	50-lb bags
Chlorax 285	sodium chlorate sodium metaborate	Powder	4	34,800 lb	Bdg M	Warehouse O	50-lb bags
Chlorea 3	sodium chlorate sodium metaborate monuron	Powder	5	3,400 lb	Bdg M	Warehouse O	50-lb bags
Chlorea 125	sodium chlorate sodium metaborate monuron	Powder	3	154,050 lb	Bdg. M	Warehouse O	50-lb bags
Sodium Metaborate	sodium metaborate	Powder	1	1,209,600 lb	Bdg M	Warehouse O	Shipped in bulk to other plants
Atlas A	sodium arsenite	Liquid	3	21,839 gal	Tank L	Tank F	30-gal drums
Atlas A-6	sodium arsenite	Liquid	4	19,300 gal	Tank L	Tank F	not known
Atlas WP&C	water and sodium chloride (inert)	Liquid	5	530 gal	Tank J	not known	5-gal buckets
Bromicil-5 (Brotab)	Bromicil and 2,3,6-Trichlobenzoic acid (<1%)	Liquid	2	138,168 gal	not known	not known	not known
Shed-A-Leaf	sodium chlorate	Liquid	1	139,000 gal	Tank L	Tank E	30-gal drums or 4000-gal tank trucks
Chlorax Liq. S.F.2	sodium chlorate	Liquid	—	150,000 gal/train[4]	Tank L	Tank E	not known

1 Active ingredients as listed on container labels in files.

2 For January 1, 1967 to October 31, 1967 as reported by C.E. Womack.

3 See Figure 16 for building and tank locations.

4 Estimated; more than 1 train per year.

3.0 COMMUNITY RELATIONS

An aggressive Community Relations program has been ongoing for all Santa Clara Valley Superfund sites, including the Rhone Poulenc/Sandoz site, and the requirements for public participation under CERCLA Section 113(k)(2)(B)(i-v) have been met. The RI/FS and Proposed Plan for the Rhone Poulenc/Sandoz site was released to the public on November 1, 1991. These two documents were made available to the public in both the administrative record and an information repository maintained at the RWQCB offices in Oakland, CA and the East Palo Alto Public Library. The RWQCB published a notice in the Peninsula Times Tribune on Wednesday, October 31, 1991 and Wednesday, November 6, 1991, announcing the RI/FS, Proposed Plan and opportunity for public comment at the Board Hearing of November 20, 1991 in Oakland, and announcing the opportunity for public comment at an evening public meeting at Tulip Jones Women's Club in the City of East Palo Alto on November 7, 1991. A thirty day public comment period on the RI/FS Report and the Proposed Plan ran from November 1, 1991 to December 2, 1991. On Wednesday, November 20, 1991 another notice was published in the Peninsula Times Tribune announcing extension of the public comment period from December 2, 1991 to December 9, 1991. A presentation of the proposed final cleanup plan was made at the February 19, 1992 and January 15, 1992 Board Hearing and the November 7th public meeting. Representatives from the RWQCB EPA, Rhone Poulenc, and contractors attended the public meeting. The RWQCB staff answered questions about problems at the site and the remedial alternatives under consideration. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this Record of Decision.

Fact Sheets for the Rhone Poulenc/Sandoz site were mailed to every known residence in East Palo Alto, local government officials, environmental organizations and interested individuals. Fact Sheet 1, mailed in August 1988, was published as four pages of the East Palo Alto's eight-page City Connection newsletter. Information in the newsletter announced additional soil borings and groundwater sampling to be conducted, summarized site risks and announced future submittal of the Remedial Investigation report.

A short notice announcing completion of the Remedial Investigation was published in the East Palo Alto newsletter, The City Connection in October 1989. A draft Feasibility Study/Remedial Action Plan was submitted on August 28, 1989. Fact Sheet 2 was distributed to the community in January 1990. This Fact Sheet announced a January 30, 1990 public meeting to present the findings of the Remedial Investigation report and update community members on the status of the project.

Fact Sheet 3 was distributed during May 1991. This fact sheet announced a community meeting for May 16, 1991 to discuss an Early Action Removal, change in agency lead status, site division into two operable units, and project schedule. A statement on the Early Action Removal was issued during the first week of September 1991. This statement provided the community with a short synopsis of the removal activities and schedule. During August 1991 a statement was issued announcing temporary work stoppage from excavation activities due to the discovery of unidentified bottles and vials. On September 23, 1991, a statement was issued that announced completion on the removal activities. All statements were hand-delivered to city offices and to the residences situated closest to the site.

Fact Sheet 4, the proposed plan, was issued on November 1, 1991. The fact sheet described the cleanup alternatives evaluated, explained the proposed final cleanup plan, announced opportunities for public comment at the Board Hearing of November 20, 1991 in Oakland and the Public Meeting of November 7, 1991 in East Palo Alto and described the availability of further information at the Information Repository at the City of East Palo Alto Public Library.

4.0 SCOPE AND ROLE OF THE RESPONSE ACTION

This ROD addresses the Upland Operable unit which includes the area delineated in Figure 1.2, and consists of contaminated soils, groundwater and surface water. This action addresses the principal threat at the site. The purpose of this response is to prevent any further horizontal migration of contaminants in the groundwater, prevent possible future exposure to the public of contaminated groundwater, prevent contamination of the drinking water aquifer, and to prevent exposure to contaminated soils. The response actions will be performed to meet the final site treatment standards listed in Table 4.1. These levels are based on Applicable or Relevant and Appropriate Requirements (ARARs) and health protection criteria for soils.

Approximately 40 chemicals, including heavy metals and low levels of pesticides and organics, were detected in the soils, groundwater, surface water, and air at the site (see Table 4.2). For the upland operable unit, five chemicals have been identified as the primary contaminants of concern in the groundwater and soil. These contaminants are arsenic, cadmium, lead, mercury, and selenium. Arsenic is a human carcinogen; cadmium and lead are probable human carcinogens; mercury is not classified as to human carcinogenicity; and epidemiological studies in humans do not suggest that excess exposure to selenium is associated with an increased risk of cancer. Cleanup standards have been assigned to all five chemicals.

The selected remedy presented herein addresses the documented potential threats from the site in the Upland Operable Unit. Containment of the contaminated groundwater will significantly reduce further migration of contaminants into a seasonal wetland. Although treatment of contained soils will not reduce arsenic toxicity, treatment will reduce the mobility of contaminants. Although, treatment of contaminated soil is driven by arsenic contamination cleanup standards for all contaminants of concern shall be met. The final cleanup standards for the suite of chemicals detected in soils equate to a industrial/ commercial use scenario and carcinogenic risk level for soil ingestion and inhalation of 1×10^{-4}.

SOIL CONTAMINATION

There are currently no ARARs established for cleanup levels in contaminated soil. The highest concentrations of contaminants detected in soils are: arsenic (54,000 mg/kg), cadmium (1,500 mg/kg), lead (13,000 mg/kg), mercury (1,900 mg/kg) and selenium (1,000 mg/kg). Table 4.3 shows estimated volume of contaminanted soil in the upland operable unit. Rhone Poulenc submitted a Baseline Risk Assessment within the Remedial Investigation

Report. EPA and the RWQCB disapproved Rhone Poulenc's risk assessment. PRC Management Inc. under contract to EPA developed a baseline risk assessment and developed health-based standards for chemicals of concern in soils at the site.

GROUNDWATER CONTAMINATION

Contaminated groundwater flows in a south to southwestern direction along the hydraulic gradient of the shallow zone potentiometric surface. The highest concentrations of contaminants in the groundwater are: arsenic (460,000 ug/l), cadmium (31 ug/l), lead (9 ug/l), mercury (13 ug/l surface water) and selenium (6,400 ug/l). The circumference of the plume is approximately 3,000 feet. Groundwater in the deep aquifer does not currently contain elevated levels of contaminants. Groudwater cleanup standards would apply in the deep aquifer groundwater zone because it is a potential source of drinking water. Deep aquifer groundwater shall be maintained at background for arsenic, cadmium, lead, mercury, and selenium. Table 4.4 identifies background levels for the contaminants as they were presented in the Remedial Investigation Report.

The site has a perimeter monitoring well network located approximately 100 feet from the 50 ppb arsenic groundwater contour line. Groundwater in these perimeter wells will not be permitted to exceed the arsenic MCL of 50 ppb. A contingency plan is set up so that a concentration of 30 ppb of arsenic triggers stepped up monitoring and 40 ppb of arsenic (based on a statistically significant sampling) triggers a requirement to pump and treat the contaminant plume for containment purposes.

The shallow groundwater is not currently considered a source of drinking water. The federal criteria for underground drinking water sources are outlined in 40 CFR 143. It states:

"Underground source of drinking water (USDW) means an aquifer or its portion:

(a) (1) Which supplies any public water system; or
(2) Which contains a sufficient quantity of groundwater water to supply a public water system; and
(i) Currently supplies drinking water for human consumption; or
(ii) Contains fewer than 10,000 mg/l total dissolved solids; and
(b) Which is not an exempted aquifer."

The shallow aquifer is not currently being used to supply a public water system. The total dissolved solid (TDS) concentrations in the shallow groundwater zone ranges from 570 mg/l up to 30,000 mg/l. TDS concentrations in the upper shallow zone is generally less saline than the lower part, and average 3000 mg/l.

The TDS concentrations in the upper zone range from 7,200 to 27,000 with a median concentration of about 17,000 mg/l. The shallow aquifer does not meet federal criteria for a drinking water aquifer. Containment of this contaminant plume is necessary. The installation of a slurry wall with maintenance of an inward hydraulic gradient will prevent horizontal migration of the contaminant plume.

The groundwater cleanup standards for the Rhone Poulenc/ Sandoz site are based on Environmental Protection Agency (EPA) maximum contaminant levels (MCLs), California Department of Health Services (DHS) MCLs (proposed or adopted), DHS Action Levels and ATSDR Toxicological Profiles for arsenic, lead, and cadmium.

TABLE 4.1 **PROPOSED CLEANUP STANDARDS**
1990 BAY ROAD SITE, EAST PALO ALTO

CHEMICALS OF CONCERN[a]	BACK-GROUND (mg/kg)	CLEANUP STANDARD[b] (mg/kg)	RISK PARAMETERS	
			Cancer Risk	Hazard Index
ONSITE [c]: ***Based on Commercial/Industrial use scenario with inhalation, ingestion exposure pathways***				
Lead(B2)[d]	50	450[e]	-	BKU
Arsenic(A)	20	500	1.7E-4	0.25
Cadmium(B1)	1.5	1,000	0.2E-4[f]	0.5
Mercury(D)	4	300	-	0.5
Selenium	4	6,000	-	1.0[g]
Total Excess Cancer Risk (rounded)			2E-4	
Segregated Noncarcinogenic Risk — *Renal (Cd + Hg)*				1.0
Neurologic (Pb + Hg)				0.5[h]
Dermal (As)				0.25
OFFSITE [i]: ***Based on Residential future use scenario with inhalation, ingestion exposure pathways***				
Lead(B2)	50	120[e]	-	BKU
Arsenic(A)	20	70	1E-4	0.14
Cadmium(B1)	1.5	250	.08E-4[f]	0.5
Mercury(D)	4	100	-	0.5
Selenium	4	2,000	-	1.0[g]
Total Excess Cancer Risk (rounded)			1E-4	
Segregated Noncarcinogenic Risk — *Renal (Cd + Hg)*				1.0
Neurologic (Pb + Hg)				0.5[h]
Dermal (As)				1.0

NOTES:

a) See Appendix K, Remedial Investigation Report.

b) Most health-protective standards calculated for industrial and residential land use scenarios, based on carcinogenic or noncarcinogenic effects.

c) Onsite includes the operating Sandoz Plant property.

d) Parenthetic notation is carcinogenic classification.

e) Based on EPA's preferred method, Lead Uptake/Biokinetic (BKU) model (Version 0.5, April, 1991).

f) Based on inhalation exposure pathway only.

g) Risk management decision not to include selenium in segregated risk because of low concentration in soil, low degree of toxic effect to humans, and beneficial antigonistic interaction with other chemicals of concern.

h) Contribution of lead to neurologic effects cannot be quantified in terms of Hazard Index.

i) Offsite includes adjacent Bains, Curtaccio, Rogge, Demeter, PG&E and City of East Palo Alto properties.

TABLE 4.2

	GROUNDWATER (mg/l)			SURFACE WATER (mg/l)		
Chemical	Frequency of Detection	Range of Detected Concentrations	Average Concen	Freq of Detect	Range of Detected Concen	Average Concen
Aluminum	1/12	0.4	0.4	0/1		
Antimony	13/35	0.005 - 0.61	0.1	1/1	.033	.033
Arsenic	432/484	0.0002 - 460	27	44/44	.0012 - 15	2.5
Barium	10/12	0.2 - 0.4	0.33	0/1		
Cadmium	60/173	0.0001 - 0.031	0.01	5/18	.0001 - .0023	.0013
Calcium	12/12	26 - 840	260	1/1	310	310
Chloroform	9/86	.002 - .092	.014	0		
Cobalt	7/13	0.001 - 0.01	0.004	1/1	.005	.005
Copper	48/139	0.007 - 0.18	0.03	6/18	.0078 - .086	.0281
DDT, DDE, DDD	0/12			0		
Dibutylphtalate	1/30	.002	.002	0		
Diethylphthalate	1/30	.05	.05	0		
1,2-Dichloroethane	8/86	.003 - .032	.016	0		
1,2-Dichloroethylene	4/86	.01 - .2	.11	0		
Freon 113	0/86			0		
Iron	6/12	0.16 - 29	9.8	1/1	.08	.08
Lead	1/138	0.009	0.009	3/18	.001 - .003	.0017
Lindane	0/12			0		
Magnesium	12/12	14 - 1100	360	1/1	1100	1100
Manganese	13/13	0.06 - 14	2.7	1/1	.37	.37
Mercury	0/138			4/18	.0001 - .0013	.00058
Nickel	14/35	0.003 - 1.15	0.18	1/1	.029	.029
Nitrosodiphenylamine	1/30	.002	.002	0		
Potassium	12/12	0.33 - 280	68	1/1	310	310
Selenium	150/186	0.0001 - 6.4	0.18	17/18	.0001 - .27	.017
Silver	9/34	0.0001 - 0.0015	0.0059	1/1	.0008	.0008
Sodium	12/12	44 - 9300	3300	1/1	10000	10000
Tetrachloroethylene	25/86	.002 - .7	.21	0		
Tin	3/12	0.024 - 0.033	0.03	0/1		
Trichloroethylene	35/86	.002 - .7	.1	0		
Vanadium	10/12	0.002 - 0.17	0.05	1/1	.036	.036
Zinc	51/138	0.01 - 0.279	0.07	5/18	.01 - .04	.026

Notes: 1. Only chemicals on U.S. EPA's Target Compound List that were detected at the site are listed.

2. Average concentrations are the calculated mean for results above the detection limit.

TABLE 4.2 (continued)

	SOIL (mg/kg)			AIR (mg/m^3)		
	Frequency	Range of	Average	Frequency	Range of	Average
Chemical	of	Detected	Concentration	of	Detected	Concen
	Detection	Concentrations		Detection	Concen	
Aluminum	11/11	8700 - 16000	13000	0		
Antimony	0/11			0		
Arsenic	1190/1409	0.1 - 54000	1100	12/28	3.6E-7 - .0005	.0001
Barium	11/11	24 - 230	120	0		
Cadmium	93/109	0.2 - 1500	63	5/13	2.4E-7 - 6.3E-7	4.5E-7
Calcium	11/11	1700 - 27000	11000	0		
Chloroform	0/11			0/4		
Cobalt	11/11	7.2 - 12.0	8.96	0		
Copper	51/53	13.0 - 2200	147	5/10	.000034 - .000116	.000067
DDT, DDE, DDD	11/36	0.025 - 13.4	1.4	2		
Dibutylphtalate	0/36			0		
Diethylphthalate	0/36			0		
1,2-Dichloroethane	0/11			0/4		
1,2-Dichloroethylene	0/11			0/4		
Freon 113	0/11			2/4	.001 - .005	.003
Iron	11/11	10000 - 22000	17000	0		
Lead	118/144	2 - 13000	670	6/17	2.0E-6 - .003	.00051
Lindane	0/36			2/2	.000011 - .000022	.000017
Magnesium	11/11	4200 - 6500	5100	0		
Manganese	11/11	220 - 390	300	0		
Mercury	93/109	0.04 - 1900	54	5/12	1.5E-7 - 3.7E-7	2.6E-7
Nickel	11/11	34 - 53	39	0		
Nitrosodiphenylamine	0/36			0		
Potassium	11/11	520 - 2200	1200	0		
Selenium	98/135	0.1 - 1000	28	0/13		
Silver	1/11	0.8	0.8	0		
Sodium	11/11	480 - 6500	1460	0		
Tetrachloroethylene	0/11			0/4		
Tin	3/11			0		
Trichloroethylene	0/11			0/4		
Vanadium	11/11	1.8 - 41.0	32	0		
Zinc	51/53	34 - 5400	510	0/5		

NOTES: 1. Only chemicals on U.S. EPA's Target Compound List that were detected at the site are listed.
2. Average concentrations are the calculated mean for results above the detection limit.

Table 4.3

ESTIMATED VOLUME OF CONTAMINATED SOIL
UPLAND OPERABLE UNIT
1990 Bay Road Site
East Palo Alto, California

	Volume of Soil (yd^3) with Arsenic Concentrations Greater than[1]				
Property Owner	20 mg/kg	135 mg/kg	500 mg/kg	1000 mg/kg	5000 mg/kg
Sandoz Property					
Operating Plant Area	48,000	27,500	12,000	6,500	790
Unpaved North Area	23,000	9,600	5,000	3,000	800
Railroad Track Area	8,000	4,700	2,500	1,300	620
Sandoz Total:	79,000	39,000	19,500	10,800	2,200
Bains Property					
Under Structures	2,000	370	165	90	-------
Parking Areas	1,500	100	25	10	-------
Bains Total:	3,500	470	190	100	-------
Curtaccio Properties:	1,500	360	35	20	-------
Rogge Property:	210	6	-------	-------	-------
Demeter Properties:	580	35	-------	-------	-------
Bay Road:	2,600	450	20	-------	-------
PG&E Poleyard:	3,900	200	-------	-------	-------
TOTAL FOR UPLAND OPERABLE UNIT (rounded):	91,000	40,500	20,000	11,000	2,200

Notes:
1. Method of calculation presented in RI Report (Geomatrix and SSP&A, 1989).
2. Shading indicates affected soil that is inaccessible until operations cease and structures are removed.

TABLE 4.4 GROUNDWATER CLEANUP STANDARDS FOR DEEP AQUIFER

Chemical	Background Concentration ug/l	MCL or DHS Action Level ug/l
ARSENIC	2.0	50
CADMIUM	1.0	5
LEAD	1.0 to 100	15*
MERCURY	< 0.5	2
SELENIUM	< 100	50 *
ANTIMONY	< 100	5*

* Background concentration shall be set to MCL.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 SOURCES OF CONTAMINATION

The Remedial Investigation focused on the distribution of arsenic and other compounds on the U.S. EPA Target Compound List in soil, groundwater, and surface water at the site. Arsenic was determined to be the primary contaminant of concern. Arsenic concentrations are almost always higher than concentrations of the other compounds, is more widespread, appears to be more mobile in groundwater than other contaminants, and the relative risk associated with arsenic is much higher.

The soil and groundwater investigations identified three primary areas where releases of arsenic compounds occurred. These three areas are: the location of the former underground mixing tank; the former sludge pond area, and along the railroad spur. Surface water runoff from the Sandoz property to the adjacent low-lying areas to the south and east was the major transport mechanism for redistribution of arsenic and other contaminants. Contaminants are present in the near-surface soil in the low-lying areas west of the levee constructed after 1955. The levee prevented surface water runoff from reaching the tidal marsh. The average background arsenic concentration in soil at the site is about 9 milligrams per kilogram (mg/kg). The qualitative assessment suggests that if the arsenic concentration in a soil sample exceeded 20 mg/kg it was impacted by site activities.

5.2 DESCRIPTION OF CONTAMINATION

GROUNDWATER

Rhone Poulenc has installed and sampled eighty-four monitoring wells in the vicinity of the site to define the extent of groundwater contamination (see Figure 5.1). Fifty-eight of these wells are useful for defining the extent and nature of the groundwater plume. Fourty wells are completed in the upper shallow zone (5 to 15 feet bgs), seventeen are completed in the lower shallow zone (20 to 35 feet bgs), and one well is completed in the upper part of the deep aquifer (170 feet bgs). EPA and the State of California have determined that groundwater in the shallow aquifer is not a potential source of drinking water because

total dissolved solids concentrations exceed both federal and state criteria for determining underground sources of drinking water.

Groundwater flow in the shallow aquifer is towards the south-southeast, but on-site flow toward the west and northwest have also been measured (see Figure 5.2 and 5.3). Groundwater contamination has been shown to occur in the lower shallow and upper shallow aquifer within an 11-acre area. Figure 5.4 and 5.5 shows the average arsenic and selenium concentrations in the shallow aquifer. The circumference of the groundwater plume is about 3,000 feet.

Wells that contain high arsenic concentrations are in the vicinity of the former sludge pond, and wells which are located adjacent to the former underground mixing tank. Soils in the vicinity of these wells are some of the most contaminated soils at the site. Only three of the seventeen wells in the lower part of the shallow aquifer exceed the arsenic MCL of 50 ppb. The well with the highest average arsenic concentration, 230,000 ppb, is located in the center of the former sludge pond (screened interval at 20 to 37 feet); the well with the next highest arsenic concentration, 1,200 ppb is located adjacent to the mixing tank (screened interval at 25 to 39 feet); and the other well with an arsenic concentration of 350 ppb is located about 150 feet downgradient of the mixing tank (screened interval at 24 to 36 feet). The concentrations of arsenic, selenium, antimony, and cadmium exceed their MCLs.

A perimeter monitoring well system encircles the groundwater plume, and will detect any significant migration of the groundwater plume (see Figure 5.6) radially outward in all directions from the site. The perimeter monitoring wells are within 100 feet of the 50 ppb arsenic contour line. The concentration of contaminants within these perimeter wells shall not exceed the arsenic MCL.

SURFACE WATER

Surface water ponds seasonally in the low-lying areas to the south (Call-Mac property) and east (Non-tidal marsh on PG & E property) of the site. This seasonally ponded surface water contains elevated concentrations of arsenic, copper, and selenium. Concentrations of lead, mercury, and zinc were at background levels. Water quality in the tidal marsh east of the site will be evaluated in the Ecological Assessment for the site.

SOIL

Soil with arsenic concentrations in excess of 20 mg/kg covers approximately 13 arces of the site. This area includes five acres on the Sandoz property, 2.4 acres of the Torres property, 3.3 acres (PG&E) in the non-tidal marsh, 1 acre in the tidal marsh, 0.8 acres on the properties to the west and 0.6 acres on the properties to the north. The vertical extent of soil with arsenic concentrations in excess of 20 mg/kg is generally less than 15 feet, except near the former underground mixing tank and the sludge pond locations. In these areas the vertical extent is as great as 34 feet below the ground surface. Soil arsenic concentrations up to 54,000 mg/kg have been detected at the site. Table 4.2 shows estimated volumes of contaminated soil in the Upland Operable Unit.

Figures 5.5 and 5.6 show the horizontal and vertical extent of arsenic contamination. During September 1991 soils with arsenic concentrations greater than 5000 mg/kg in accessible areas were removed (see Figure 2.1).

5.3 CONCLUSION

Data used to develop the Feasibility Study, to select remedial alternatives and to develop conclusions and clean-up standards presented in this Record of Decision were based on the following data quality requirements:

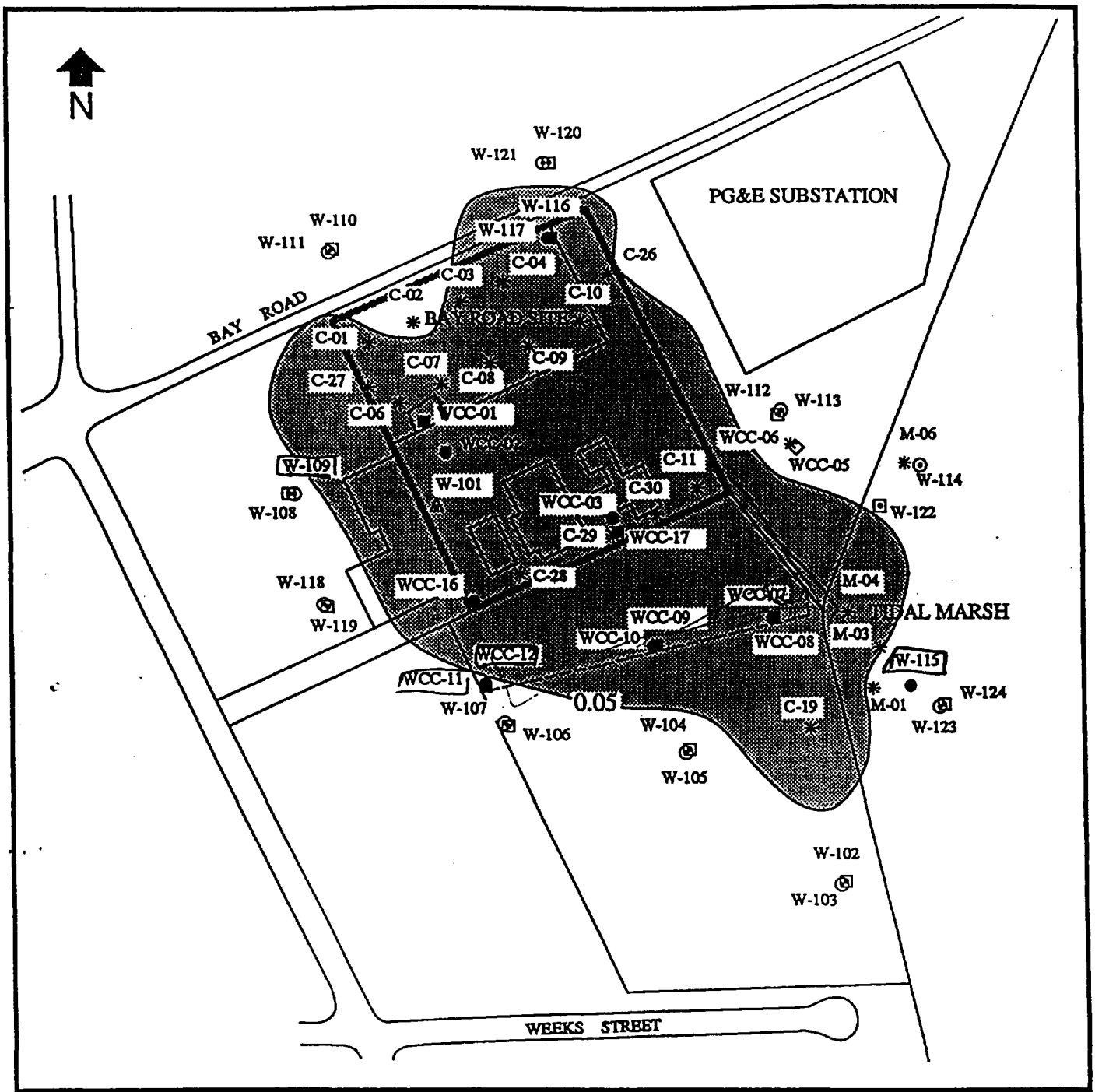
1) All data were collected under the guidance of a Quality Assurance Project Plan developed under EPA protocols and reviewed and approved by California Department of Health Services Quality Assurance Management staff.

2) All data were collected in accordance with procedures presented in an approved Sampling and Analysis Plan. The Sampling and Analysis Plan was developed in accordance with EPA Region 9 guidance and were reviewed and approved by EPA staff.

3) Random sample splits were collected by Board staff to confirm the validity of data generated.

4) Selected data was validated by the Department of Health Services and found to be qualitatively and quantitatively acceptable.

5) There has been reasonable repeatability of the data based on years of monitoring.



Explanation

Monitoring Network wells:

- ⊙ Upper shallow zone perimeter montoring wells
- ⊡ Lower shallow zone perimeter montoring wells
- ▲ Deep aquifer well
- ● Other upper shallow zone wells
- ■ Other lower shallow zone wells

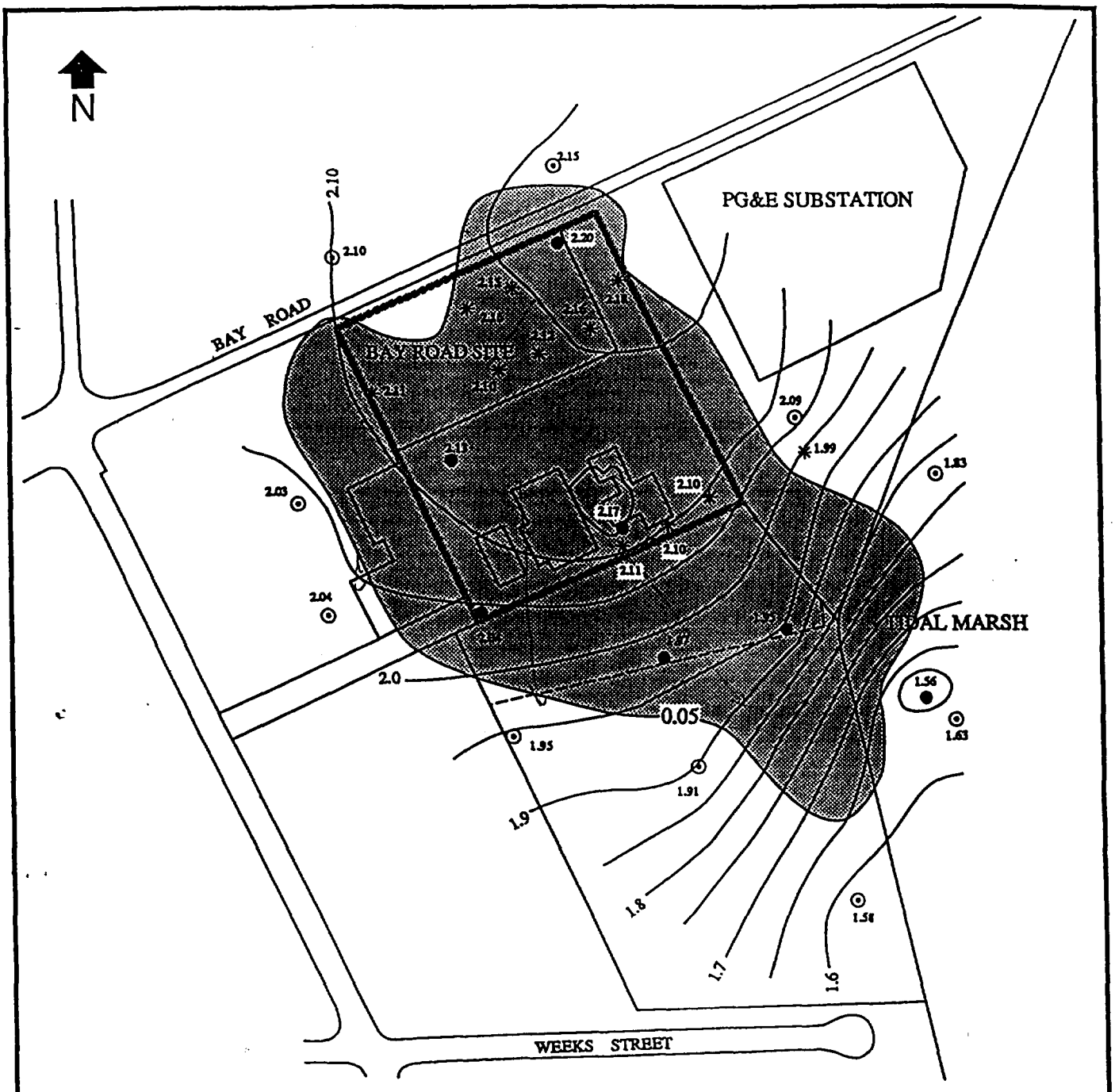
Other wells:

- ✳ Other upper shallow zone wells
- ◇ Other lower shallow zone wells
- ▒ Area with Arsenic > 0.05 mg/l in ground water

0 250 500

Scale feet

$\Sigma^2\Pi$ S.S. PAPADOPULOS & ASSOCIATES, INC. CONSULTING GROUND-WATER HYDROLOGISTS	LOCATIONS OF WELLS	FIGURE 5.1



Explanation

Monitoring Network wells:

- ⊙ Upper shallow zone perimeter montoring wells
- ● Other upper shallow zone well

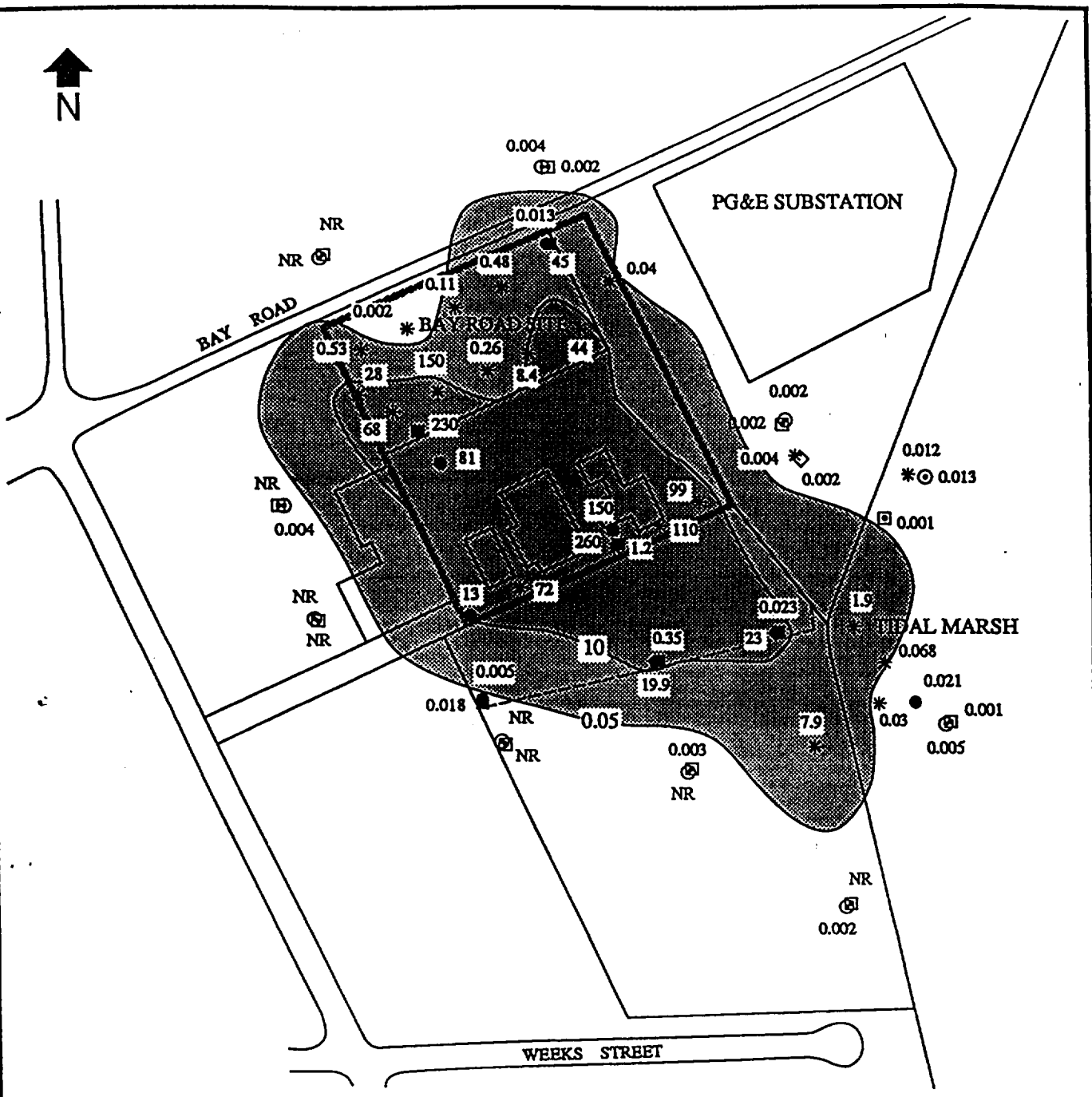
Other wells:

- ✳ Other upper shallow zone wells
- 1.56 Water level measured in well (feet above MSL)
- ▒ Area with Arsenic > 0.05 mg/L in ground water

0 250 500

Scale feet

S.S. PAPADOPULOS & ASSOCIATES, INC. CONSULTING GROUND-WATER HYDROLOGISTS	CONTOUR MAP OF JUNE 1990 WATER LEVELS UPPER SHALLOW ZONE	FIGURE 5.2



Explanation

Monitoring Network wells:

- ⊙ Upper shallow zone perimeter montoring wells
- ⊡ Lower shallow zone perimeter montoring wells
- ● Other upper shallow zone wells
- ■ Other lower shallow zone wells

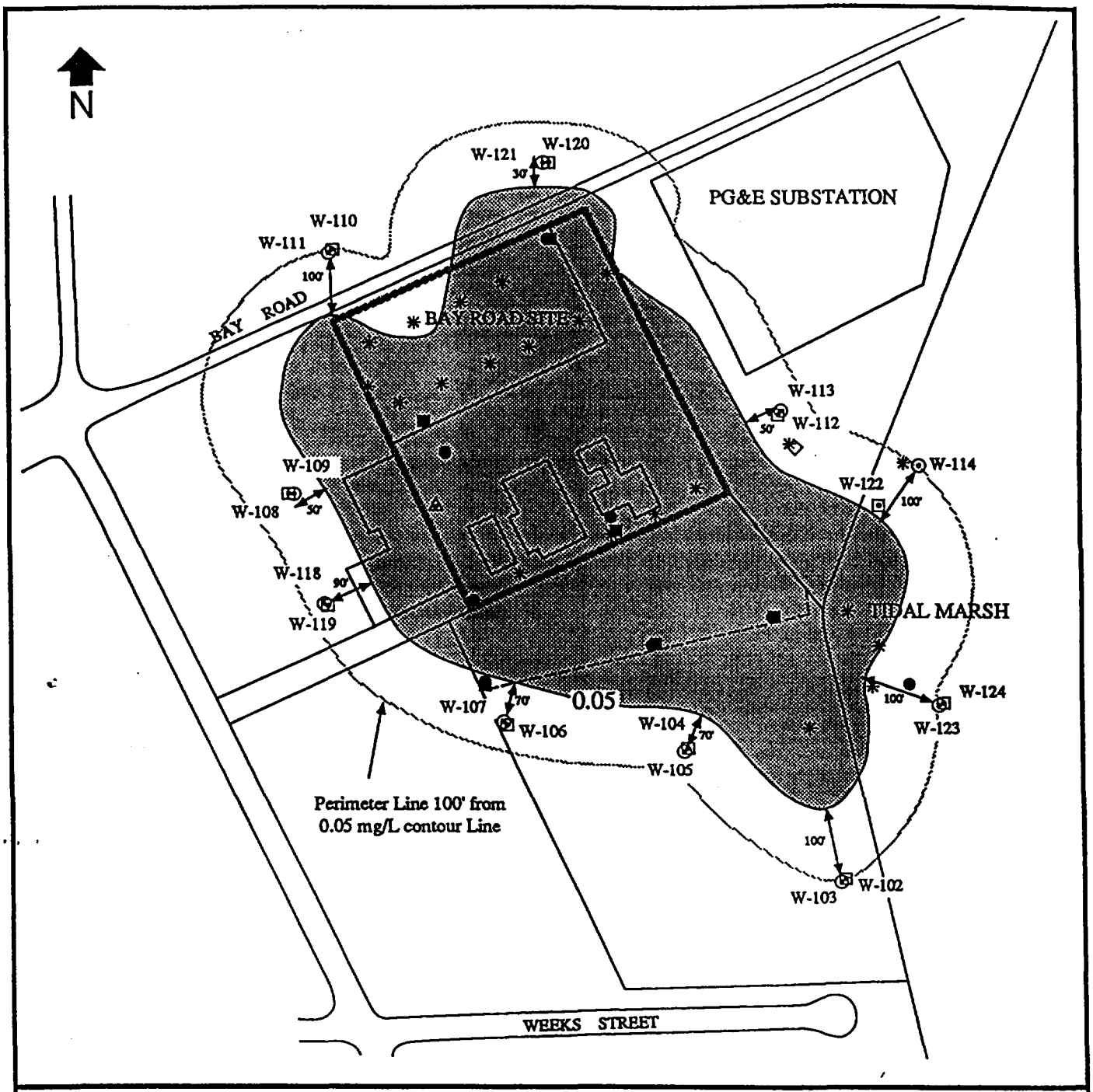
Other wells:

- ✳ Other upper shallow zone wells
- ◇ Other lower shallow zone wells
- 0.03 Average Arsenic concentration detected in well (mg/L)
- NR Average Arsenic concentration detected less than 0.001 mg/L

0 250 500

Scale feet

S.S. PAPADOPULOS & ASSOCIATES, INC. CONSULTING GROUND-WATER HYDROLOGISTS	AVERAGE CONCENTRATION OF ARSENIC IN SHALLOW AQUIFER	FIGURE 5.3



Explanation

Monitoring Network wells:

- ⊙ Upper shallow zone perimeter montoring wells
- ⊡ Lower shallow zone perimeter montoring wells
- ◬ Deep aquifer well
- ● Other upper shallow zone wells
- ■ Other lower shallow zone wells

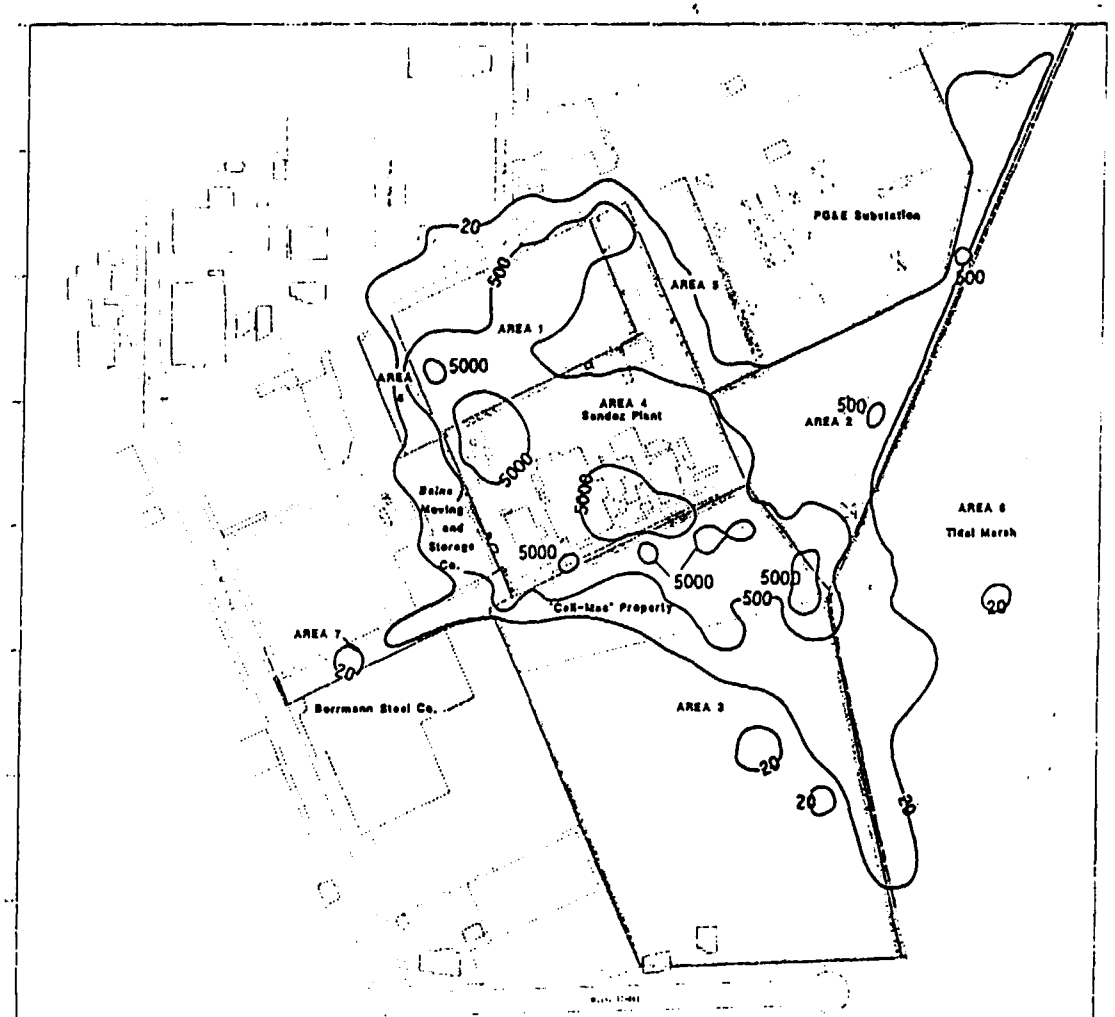
Other wells:

- ✳ Other upper shallow zone wells
- ◇ Other lower shallow zone wells
- ▒ Area with Arsenic > 0.05 mg/l in ground water

0 250 500

Scale feet

S.S. PAPADOPULOS & ASSOCIATES, INC. CONSULTING GROUND-WATER HYDROLOGISTS	PERIMETER MONITORING WELLS	FIGURE 5.4



KEY

—— Contours delimiting area containing soil concentrations in excess of labeled concentration (mg/kg)

Note

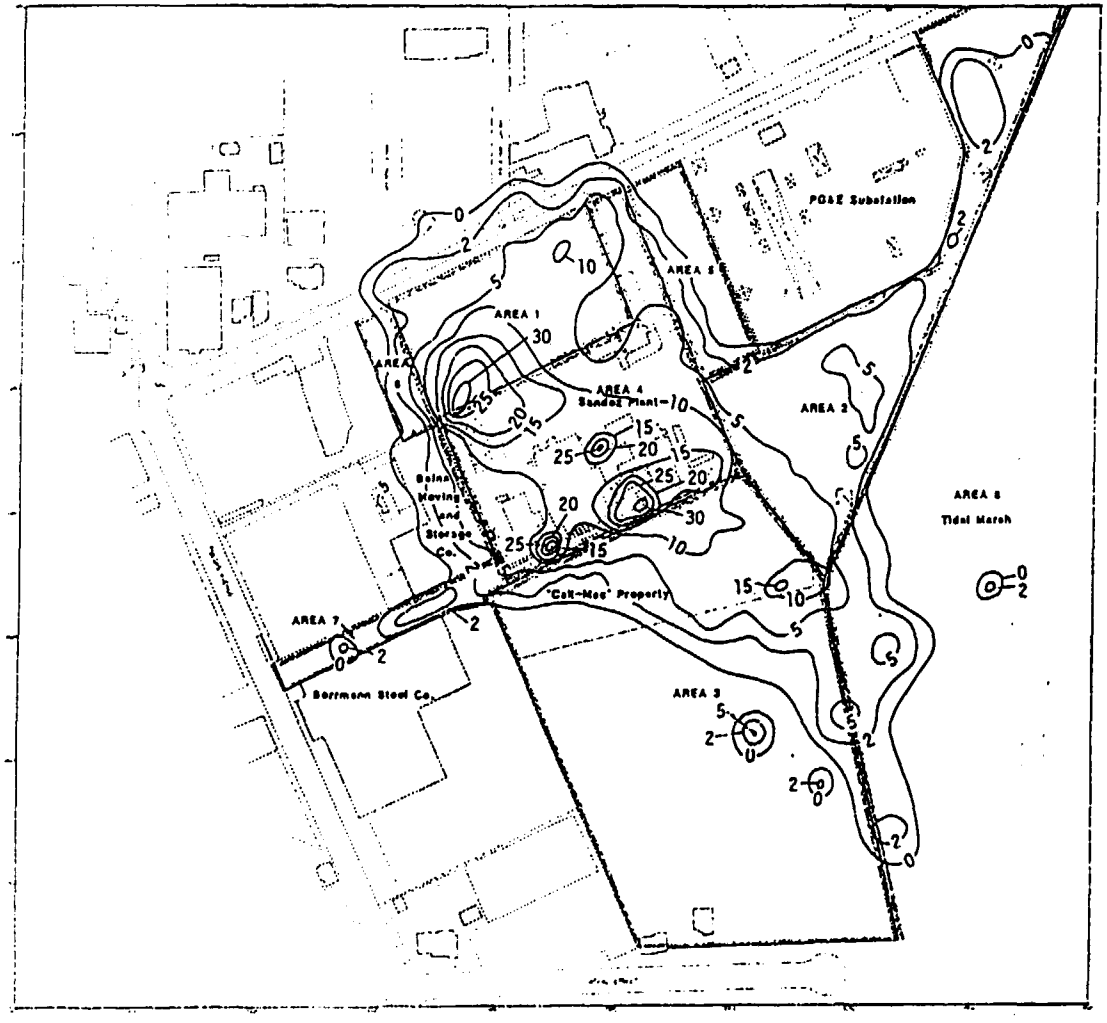
Contours based on soil boring data presented in Appendices D and E.

N

0 200 Feet

CONTOURS OF SOIL ARSENIC CONCENTRATIONS
1990 Bay Road Site and Vicinity
East Palo Alto, California

GEOMATRIX	Project No.	Figure
	1220A-1500	5.5



KEY

—— Contour of approximate depth in feet of soil containing greater than 20 mg/kg arsenic

Note

Contours based on soil boring data presented in Appendices D and E.

N

0 200 Feet

VERTICAL EXTENT OF SOIL WITH ARSENIC CONCENTRATIONS GREATER THAN 20 mg/kg
1990 Bay Road Site and Vicinity
East Palo Alto, California

GEOMATRIX	Project No.	Figure
	1220A-1500	5.6

Revised 2/13/09

6.0 SUMMARY OF SITE RISKS

Rhone Poulenc prepared a baseline risk assessment as chapter five of the Remedial Investigation report dated September 19, 1989. This risk assessment assessed the cumulative carcinogenic risk and non-carcinogenic hazard quotient for a reasonable maximum exposure for current land use. Receptors considered were on-site workers, neighboring residents, recreational visitors, construction workers, and site trespassers. Agency personnel reviewing this risk assessment noted a number of problems with the calculations as they were presented. It was agreed that Rhone Poulenc would revise risk calculations in an appendix to the Feasibility Study. As a result of problems associated with the Risk Assessment, the approximate calculations were made in a document submitted by EPA's contractor on February 18, 1992.

6.1 CONTAMINANT IDENTIFICATION

Approximately 40 chemicals were detected on site in soils, groundwater, surface water and air. The chemicals that pose a significant hazard at the site were identified by following a series of steps recommended in the "Superfund Public Health Evaluation Manual" (SPHEM) dated October 1986, and the Region IX Superfund Risk Assessment Guidelines dated 18 August 1988, which were acceptable guidance documents at the time. Based on these guidance documents a first cut analysis was performed to eliminate chemicals which were 1) present at background concentrations; 2) present in not more than two media above background but below appropriate regulatory criteria or standards; 3) present above regulatory criteria but not widely distributed throughout the site; and 4) no route for human exposure existed. The following five chemicals of potential concern were identified within the Study Area: arsenic, cadmium, selenium, mercury and lead. Arsenic, cadmium, selenium, mercury and lead were consistently detected in the samples collected throughout the plume area. Table 4.2 lists detection freqencies, average concentrations, and maximium concentrations for all site compounds including chemicals of concern.

EPA assigns weight-of-evidence classifications to chemicals that may be potential carcinogens. Under this system, chemicals are classified as either Group A, Group B1, Group B2, Group C, Group D, or Group E. Group A chemicals (known human carcinogens) are agents for which there is sufficient evidence to support the causal association between exposure to the agents in humans and cancer. Groups B1 and B2 chemicals (probable human carcinogens) are agents for which there is limited (B1), or inadequate (B2) evidence of carcinogenicity from human studies, but for which there is sufficient evidence of carcinogenicity from animal studies. Group C chemicals (possible human carcinogens) are agents for which there is limited evidence of carcinogenicity in

animals, and Group D chemicals (not classified as to human carcinogenicity) are agents with inadequate human and animal evidence of carcinogenicity or for which no data are available. Group E chemicals (evidence of noncarcinogenicity in humans) are agents for which there is no evidence of carcinogenicity in adequate human or animal studies.

For the Rhone Poulenc site one of the chemicals of concern is a carcinogen, and two are potential carcinogens. Arsenic was identified by EPA as a human carcinogen (Group A) based on available laboratory animal data. Cadmium and lead were identified by EPA as probable human carcinogens (Group B1 and B2) based on available laboratory animal data. Mercury remains unclassified as a potential carcinogen because there is inadequate evidence of its carcinogenicity in animal studies. Selenium's epidemiological studies in humans do not suggest that excess exposure is associated with an increased risk of cancer.

EXPOSURE ASSESSMENT

The perinent exposure pathways identified were ingestion of soil and inhalation of soil particulates. The dermal contact to the soils pathway was not evaluated because metals are not expected to be readily adsorbed through the skin.

TOXICITY ASSESSMENT

Arsenic is considered to be a rare but ubiquitous element with an average crustal abundance of 2-5 ppm. Arsenic has an extremely complex chemistry, with stability in four oxidation states under naturally occuring pH and oxidation potentials (Eh). This range of valences, and factors influencing valence transformation, are extremely important in determining toxicity. For example, As III and As V are the most toxic and the +3 state is much more toxic than the +5 state. Some factors influencing arsenic valence include ph, temperature, salinity, and metal sulfide and sulfide ion concentrations. Due to arsenic's chemical similarity to phosphorus it interferes with human biochemical reactions involving the phosphorous. Chronic exposure to arsenic by ingestion or inhalation causes a variety of cardiovascular, central and peripheral nervous system and dermal disorders, such as skin hardening and cancer.

Cancer potency factors (CPFs) have been developed by EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs (currently slope factors), which are expressed in units of $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake

of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. The oral and inhalation cancer potency factor for arsenic was 1.8 $(mg/kg\text{-}day)^{-1}$ and 15 $(mg/kg\text{-}day)^{-1}$. The inhalation cancer potency factor for cadmium was 6.1 $(mg/kg\text{-}day)^{-1}$. A oral cancer potency factor is not available for cadmium.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. The RfD's for the five chemicals of concern are listed below;

Chemical	Oral RfD (critical Effect)	Inhalation RfD (critical Effect)
Arsenic	1.0E-03	NA
Cadmium	1.0E-03	NA
Lead	1.6E-04*	NA
Mercury	3.0E-04	8.6E-05
Selenium	3.0E-03	NA

* The oral RfD for lead was based on a MCL level of 5 parts per billion (ppb) and the following intake assumptions: an ingestion rate of 2 liters of water per day and an average body weight of 70 kg.

6.2 RISK CHARACTERIZATION

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation(e.g., 1×10^{-6} or 1E-6). An excess lifetime cancer risk of 1×10^{-6} indicates that, as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year

lifetime under the specific exposure conditions at a site. A carcinogenic risk of 1×10^{-3} is equal to one excess occurrence of cancer in a population of 1000. EPA's acceptable carcinogenic risk range for cleanup standards selected for a site is 10^{-4} (1 in 10,000) to 10^{-6} (1 in 1,000,000).

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. If the noncarcinogenic Hazard Index is less than one, EPA considers the combined intake of chemicals unlikely to pose a health risk.

Due to the lack of 95th upper confidence limits of the arithmetic mean, only average or maximum concentrations were used in estimating the baseline cumulative health risks for the residential and commercial/industrial scenarios. The residential scenario, using average concentrations for arsenic and cadmium showed a risk of 2×10^{-3} and a hazard index of 2.5 with arsenic contributing 99.9 percent of the carcinogenic and noncarcinogenic risk. The residential scenario, using maximum concentrations for arsenic and cadmium showed a risk of 8×10^{-2} and a hazard index of 121 with arsenic contributing 99.9 percent of the carcinogenic and non-carcinogenic risk.

Thus the carcinogenic risk and Hazard Index associated with a "no action" remedy exceed EPA's acceptable carcinogenic risk and Hazard Index range. Table 6.1 provides the calculation of baseline cumulative health risks associated with exposure to the upland soils.

The carcinogenic risk and noncarcinogenic hazard at the cleanup standards associated with the ingestion of soils and inhalation of heavy metals using the maximum exposure scenario is shown on Table 6.2. The selected remedy is protective of human health and the environment -- as required by Section 121 of CERCLA -- in that contamination in soil is treated to at least these health-based standards and falls within EPA's acceptable carcinogenic risk range (10^{-6} to 10^{-4}) and noncarcinogenic Hazard Index of less than one.

6.3 PRESENCE OF SENSITIVE HUMAN POPULATIONS

In order for a chemical to pose a human health risk, a complete exposure pathway must be identified. The greatest potential for exposure to chemicals at the site would be from residential uses. The BPHE did not identify potential exposure pathways

under current land use conditions and did not identify sensitive human populations. The closest residences are approximately 500 feet southwest of the site. Although several elementary schools located in the area, the closest school is Ravenswood Children Center (grades K-5, approximately 185 students) which is located at 1286 Runnymede Avenue. There are no day care centers or convalescent homes located in the immediate vicinity of the site.

6.4 PRESENCE OF SENSITIVE ECOLOGICAL SYSTEMS

In May 1990 Rhone Poulenc submitted an Ecological Assessment Workplan. This Workplan was designed using the EPA guidance document entitled Ecological Assessments of Hazardous Waste Sites: A Field and Laboratory Guide. This workplan was designed to address migration of contaminants into the tidal marsh and non-tidal marsh located adjacent to the site.

The overall goal of the workplan was to collect very detailed sediment quality, water quality, and bioassay data, as well as additional physiological bioaccumulation, and population and community data. The study will also generate a certain amount of data on ecosystem productivity.

WETLANDS

NON-TIDAL MARSH

The non-tidal marsh is a disturbed environment that is seasonnaly flooded. In the low-lying portion of the marsh seasonally ponded water is acessible to and attracts water-oriented birds during portions of the year. Plant life is patchy within this area and consists largely of the salt-tolerant salt grass (Distichlis spicata) with lesser amounts of sea-blite (Suaeda californica) and picklweed (Salicornia virginica). Other species observed in the non-tidal wetland include fathen (Atriplex patula var. hastata), alkali heath (Frankenia grandifolia), ryegrass (Lolium spp.), rabbit's-foot grass (Polypogon elongatus), sand-spurrey (Spergularia marina), and dock (Rumex spp.).

TIDAL MARSH

The tidal marsh east of the levee is a mid to upper-elevation tidal marsh approximately 1,800 feet west of the tidal mudflats of southern San Francisco Bay. Elevations of the marsh range from about 3.5 to 6.5 feet (NGVD). The marsh floods during higher spring tides and winter storms. The plant community is dominated by picklweed (Salicornia virginica) and salt grass (Distichlis spicata), with Pacific cord grass (SPartina foliosa) denser in lower elevation areas and tidal channels, and gum-plant (Grindelia humilis), fathen (Atriplex patula var. hastata), alkali heath (Frankenia grandifolia), and jaumea (Jaumea carnosa) in slightly higher elevation areas. The marsh vegetation is

classified as estaurine, intertidal, emergent, and persistent in the U.S. Fish and Wildlife Service National Wetlands Classification System.

The marsh is flooded and drained by several small tidal channels lined with cordgrass. The sidewalls and bottoms of the channels are rich in benthic organisms, and are typical of many such tidal channels in the south San Francisco Bay. Included among the typical channel bottom benthic organisms are the Baltic clam (Macoma balthica), the ribbed mussel (Ischadium dimissum), and the yellow shore crab (Hemigrapsus oregonensis). A moderately sized benthic population with a diversity and species composition typical of the south Bay was found.

The shallow tidal channels at the site also provide food and protection for juvenile fish and other small non-game fish. The topsmelt(Atherinops affinis), arrow goby (Clevelandia ios), and stickleback (Gasterosteus aculeatus) are species observed and/or collected during the ecological assessment field work.

Two endangered species are reported to use South San Francisco Bay, located approximately 11 miles northwest of the Study Area. The California clapper rail (Rallus longirostris obsoletus) and the salt marsh harvest mouse (Reithrodontomys raviventris) are reported to exist in the tidal marshes of the Bay and bayshore. The endangered California brown pelican is occasionally seen in the Bay Area, but does not nest in the South Bay. Ranges of the endangered American peregrine falcon and southern bald eagle include the Bay Area. The southern bald eagle does not use bay and bayshore habitats, but the perigrine falcon has started to make a comeback at some northern locations in San Francisco Bay. Approximately 33 bird species have been observed drinking, feeding, bathing or roosting in the seasonnaly ponded areas of the Rhone Poulenc site. Of the 33 species observed during a four-day period in January 1988, 7 were shorebirds, 6 were waterfowl, and the remaining 20 were species of songbirds and raptors. The highest number of individuals using the site included 98 European starlings, 84 mourning doves, 57 Brewer's blackbirds and 34 red-winged blackbirds.

A Clapper Rail survey was conducted in April 1990. This study estimated the locations of 21 Clapper Rail pairs and 15 non-paired individuals. The survey results estimated for the 34.4 hectare (85 acre) marsh, a density of 1.66 rails per hectare (0.67 rails per acre) based upon a population of 57 rails. This estimate is well above most density estimates for marshes within San Francisco Bay. During the trapping of surrogate species for the small mammal study portion of the Ecological Assessment salt marsh harvest mouse were trapped and released. Mourning doves (84 individuals), Brewers blackbirds, European starling (98 individuals) have also been observed on site.

The results of the Ecological Assessment will be presented in a report to be submitted in March of 1992 and a final Record of Decision for the site that will address the Wetlands will be completed during 1993.

6.5 CONCLUSION

Actual or threatened releases of hazardous substances from the Rhone Poulenc site, if not addressed by implementing the response action selected in this ROD may present an imminent and substantial endangerment to the public health, welfare or environment. Based on the fact that a variety of the heavy metals detected in the Study Area pose significant health risks as carcinogens or as noncarcinogens and complete exposure pathways exist, EPA has determined that remediation is warranted.

TABLE 6.1

BASELINE CUMULATIVE HEALTH RISKS
ASSOCIATED WITH EXPOSURE TO THE UPLAND SOILS

Chemical of Potential Concern (a)	Chemical Concentration (mg/kg)	Health Risk/Hazard (b)	
		Cancer Risk	Hazard Index
Residential - Average			
Arsenic (A)	1,050	2E-03	2.1
Cadmium (B1)	68	2E-06 (c)	0.1
Lead (B2)	590	---	BKU (d)
Mercury (D)	65	---	0.3
Selenium	35	---	0.02
Cumulative Risk/Hazard		**2E-03**	**2.5**
Residential - Maximum			
Arsenic (A)	54,000	8E-02	108
Cadmium (B1)	1,500	5E-05 (c)	3
Lead (B2)	1,300	---	BKU (e)
Mercury (D)	1,900	---	9.5
Selenium	1,000	---	0.5
Cumulative Risk/Hazard		**8E-02**	**121.0**
Commercial/industrial - Average			
Arsenic (A)	1,050	4E-04	0.5
Cadmium (B1)	68	1E-06 (c)	0.03
Lead (B2)	590	---	BKU (f)
Mercury (D)	65	---	0.1
Selenium	35	---	0.006
Cumulative Risk/Hazard		**4E-04**	**0.6**
Commercial/industrial - Maximum			
Arsenic (A)	54,000	2E-02	27
Cadmium (B1)	1,500	3E-05 (c)	0.8
Lead (B2)	1,300	---	BKU (g)
Mercury (D)	1,900	---	3.2
Selenium	1,000	---	0.2
Cumulative Risk/Hazard		**2E-02**	**31.2**

NOTES:

(a) Parenthetic notation next to chemical name is EPA carcinogenic weight-of-evidence classification.

(b) Cancer risk or hazard index was calculated for the ingestion of soil and inhalation of particulates pathways.

(c) Excess cancer risk for cadmium was calculated for the inhalation of particulates pathway only.

(d) Based on EPA's preferred method, the Lead Uptake/Biokinetic (BKU) model (Version 0.5, April 1991). Comparison of 590 mg/kg to the preliminary HBG of 250 mg/kg indicates potential adverse effects to children.

(e) Comparison of 1,300 mg/kg to the preliminary HBG of 250 mg/kg indicates potential adverse effects to children.

(f) Comparison of 590 mg/kg to the preliminary HBG of 900 mg/kg indicates no potential adverse effects.

(g) Comparison of 1,300 mg/kg to the preliminary HBG of 900 mg/kg indicates non-definitive potential adverse effects to workers.

TABLE 6.2

RECOMMENDED FINAL HEALTH-BASED GOALS AND ASSOCIATED CUMULATIVE RISKS

Chemical of Potential Concern (a)	Final Health-based Goal (mg/kg) (b)	Cumulative Risk/Hazard	
		Cancer Risk	Hazard Index
Residential			
Arsenic (A)	70	1E-04	0.1
Cadmium (B1)	250	8E-06	0.5
Lead (B2)	120 (c)	---	BKU
Mercury (D)	100	---	0.5
Selenium	2,000	---	1.0 (d)
Total Excess Cancer Risk		**1E-04**	
Segregated Noncarcinogenic Hazard	**Dermal (As)**		**0.1**
	Neurologic (Pb + Hg)		**0.5 (e)**
	Renal (Cd + Hg)		**1.0**
Commercial/industrial			
Arsenic (A)	500	2E-04	0.3
Cadmium (B1)	1,000	2E-05	0.5
Lead (B2)	450 (c)	---	BKU
Mercury (D)	300	---	0.5
Selenium	6,000	---	1.0 (d)
Total Excess Cancer Risk		**2E-04**	
Segregated Noncarcinogenic Hazard	**Dermal (As)**		**0.3**
	Neurologic (Pb + Hg)		**0.5 (e)**
	Renal (Cd + Hg)		**1.0**

NOTES:

As - Arsenic; Cd - Cadmium; Pb - Lead; Hg - Mercury.

(a) Parenthetic notation next to chemical name is EPA carcinogenic weight-of-evidence classification.

(b) Final health-based goals are the most health-protective values, based either on carcinogenic risk or noncarcinogenic hazard for the ingestion of soil and inhalation of particulates pathways.

(c) Based on EPA's preferred method, the Lead Uptake/Biokinetic (BKU) model (Version 0.5, April 1991).

(d) Risk management decision not to include selenium in segregated hazard because of its low concentration in soil, low degree of toxic effects to humans, and beneficial antagonistic interaction with other CsOPC.

(e) Contribution of lead to neurologic effects cannot be quantified in terms of Hazard Index.

7.0 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS)

Under Section 121(d)(1) of CERCLA, remedial actions must attain a degree of clean-up which assures protection of human health and the environment. Additionally, remedial actions that leave any hazardous substance, pollutant, or contaminant on-site must meet a level or standard of control that at least attains standards, requirements, limitations, or criteria that are "applicable or relevant and appropriate" under the circumstances of the release. These requirements, known as "ARARs", may be waived in certain instances, as stated in Section 121(d)(4) of CERCLA.

"Applicable" requirements are those clean-up standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant or contaminant, remedial action, location, or other circumstance at a CERCLA site. "Relevant and appropriate" requirements are clean-up standards, standards of control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. For example, requirements may be relevant and appropriate if they would be "applicable" but for jurisdictional restrictions associated with the requirement. See the National Contingency Plan, 40 C.F.R. Section 300.6, 1986).

The determination of which requirements are "relevant and appropriate" is somewhat flexible. EPA and the State may look to the type of remedial actions contemplated, the hazardous substances present, the waste characteristics, the physical characteristics of the site, and other appropriate factors. It is possible for only part of a requirement to be considered relevant and appropriate. Additionally, only substantive requirements need be followed. If no ARAR covers a particular situation, or if an ARAR is not sufficient to protect human health or the environment, then non-promulgated standards, criteria, guidance, and advisories must be used to provide a protective remedy.

7.1 TYPES OF ARARS

There are three types of ARARs. The first type includes "contaminant specific" requirements. These ARARs set limits on concentrations of specific hazardous substance, contaminants, and contaminants in the environment. Examples of this type of ARAR are ambient water quality criteria and drinking water standards.

The second type of ARAR includes location-specific requirements that set restrictions on certain types of activities based on site characteristics. These include restriction on activities in wetlands, floodplains, and historic sites. The third type of ARAR includes action-specific requirements. These are technology-based restrictions which are triggered by the type of action under consideration. Examples of action-specific ARARs are Resource Conservation and Recovery Act ("RCRA") regulations for waste treatment, storage, and disposal.

ARARs must be identified on a site-specific basis from information about specific chemicals at the site, specific features of the site location, and actions that are being considered as remedies.

The ARARs for the Rhone Poulenc site are identified in Table 7.1 and Table 9.1 lists contaminant specific ARARs to be met by the Rhone Poulenc site.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

RHONE POULENC/SANDOZ Site
East Palo Alto, California

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Federal Requirements, Criteria, or Limitations				
Safe Drinking Water Act	42 U.S.C. § 300f et seq. Pub. L 93-523	Goal of the Act is to protect human health by protecting the quality of drinking water. The Act authorizes establishment of drinking water standards.	Yes/No	Applies to CERCLA site discharges to public drinking water sources, including underground drinking water sources.
National Primary Drinking Water Standards	40 CFR Part 141	Establishes primary maximum contaminant levels (MCLs) that are health-based standards for public water systems.	Yes/No	MCLs are ARARs for any water that is considered a source or potential source of drinking water. MCLs are applicable at the tap when water is provided directly to 25 or more people or 15 or more service connections. Otherwise, MCLs are relevant and appropriate.
Maximum Contaminant Level Goals (MCLGs)	40 CFR 141, Subpart F	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects, with an adequate margin of safety.	No/Yes	MCLGs are not federally enforceable drinking water standards, but CERCLA § 121(d) has raised MCLGs and water quality criteria (see below) to the level of potentially relevant and appropriate. MCLGs may be considered when a CERCLA cleanup may require more stringent standards than the MCLs.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
				EPA has established that the use of MCLGs will be decided on a case-by-case basis. MCLGs are relevant and appropriate when the chemical-specific goal is not zero.
Clean Water Act	33 U.S.C. § 1251-1376	Provides for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. Enabling statute for a system of minimum national standards for effluent discharge; a construction grant program for POTWs; ocean discharge requirements; and water quality criteria.	Yes/No	
Water Quality Criteria	40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986	Federal water quality criteria are guidelines from which states establish their water quality standards. Criteria are developed for the protection of human health and aquatic life.	No/Yes	Applicable to direct discharges to surface waters. An indirect discharge to a POTW may be considered an off-site activity even if the conveyance system is on site. A POTW may require a CERCLA wastewater to meet "pretreatment" standards prior to acceptance. If a water quality standard is available for a contaminant, that standard should be used rather than the criteria. Basin Plans established water quality standards in the states. Water

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
				quality criteria are relevant and appropriate when no standard exists.
Toxic Pollutant Effluent Standards	40 CFR Part 129	Establishes effluent standards or prohibitions for certain toxic pollutants: aldrin/dieldrin, DDT, endrin, toxaphene, benzidine, PCBs.	No/No	Applies to specified facilities that discharge into navigable waters.
National Pollutant Discharge Elimination System	40 CFR Part 122, 125	Requires permits for the discharge of pollutants from any point source into waters of the United States. The Act defines a point source as any discernable, confined, or discrete conveyance from which pollutants are or may be discharged. Effluent limitations must protect beneficial uses of water.	Yes/No	Substantive requirements apply to discharges to surface water bodies or to the local storm drain system. Pretreatment standards may have to be met for discharges to the POTW.
National Pretreatment Standards	40 CFR Part 403	Sets standards to control pollutants that pass through or interfere with treatment processes in publicly owned treatment works (POTW) or that may contaminate sewage sludge.	Yes/No	

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Clean Air Act	42 U.S.C. §§ 7401 et seq.	Regulates emissions to protect human health and the environment. Enabling satute for major provisions such as National Ambient Air Quality Standards, NESHAPs, NSPS.	No/Yes	Substantive requirements of the various programs (e.g., NESHAPs, NSPS) provided by the Clean Air Act are implemented primarily through the regional Air Pollution Control Districts for stationary sources. Applicable to remedial alternatives that may result in air emissions.
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes National Ambient Air Quality Standards (NAAQS) for the protection of public health and welfare.	No/Yes	Primary standards applicable to any alternative emitting regulated pollutants.
National Emission Standards for Hazardous Air Pollutants (NESHAPs)	40 CFR Part 61	Sets emission standards, monitoring, and testing requirements for designated hazardous pollutants such as inorganic arsenic. Standards apply only to sources specifically named in the regulations.	No/Yes	Chemicals regulated by NESPHAPs have been identified at the site, but emission sources named in the regulation are not components of the remedial alternatives under evaluation.
Solid Waste Disposal Act	42 U.S.C. §§ 6901-6987	This law has been amended by RCRA and HSWA.		
Hazardous Waste Management Systems General	40 CFR Part 260	Provides definitions of hazardous waste terms, procedures for rule-making petitions, and procedures for	Yes/Yes	Definitions may be applicable or relevant and appropriate to various potential activities. May be applicable

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
		delisting a waste.		if variances or delisting is required.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Yes/No	Applicable if the selected alternative involves generation and off-site transportation of hazardous waste.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (RCRA)	40 CFR Part 264	Establishes minimum national standards that define the acceptable management of hazardous waste for owners and operators of facilities that treat, store, or dispose of hazardous waste.	Yes/Yes	Any remedy that involves current treatment, storage, or disposal generally will be applicable. If the action does not involve current treatment, storage, or disposal, it may be relevant and appropriate.
General Facility Standards	40 CFR 264.10, et seq. Subpart B		Yes/Yes	Applicable to on-site treatment, storage, or disposal of hazardous waste. Location standards (i.e., setback from a Holocene fault and design, construction, operation, and maintenance standards relative to the 100-year flood) may be applicable for a new landfill.
Preparedness and Prevention	40 CFR 264.30, et seq. Subpart C		Yes/No	Applicable to on-site treatment, storage, or disposal of hazardous waste.
Contingency Plan and Emergency Procedures	40 CFR 264.50, et seq. Subpart D		Yes/No	Applicable to on-site treatment, storage, or disposal of hazardous

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
				waste.
Manifest System, Record-keeping, and Reporting	40 CFR 264.70, et seq. Subpart E		Yes/No	Applicable only if waste is transported for off-site treatment, storage, or disposal.
Releases from Solid Waste Management Units	40 CFR 264.90, et. seq. Subpart F		Yes/No	Applicable if hazardous waste remains on site. The maximum contaminant concentrations that can be released from hazardous waste units are identical to the MCLs.
Closure and Post-Closure	40 CFR 264.110, et seq. Subpart G		Yes/No	Applicable if hazardous waste is treated or stored in a new on-site unit. Not applicable to consolidation within area of contamination or to in situ treatment.
Financial Requirements	40 CFR 264.140, et seq. Subpart H		Yes/No	Applicable for closure/post-closure of any treatment unit.
Use and Management of Containers	40 CFR 264.170, et seq. Subpart I		Yes/No	Applicable if alternative involves storage of hazardous waste in containers.
Tank Systems	40 CFR 264.190, et seq. Subpart J		No/No	Applicable if alternative involves treatment or storage of hazardous waste in tank system(s).

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Surface Impoundments	40 CFR 264.220, et seq. Subpart K		No/No	No alternative is being considered that would use a surface impoundment.
Waste Piles	40 CFR 264.250, et seq. Subpart L		Yes/No	Applicable if alternative involves storage of hazardous waste in waste piles for more than 90 days.
Miscellaneous Units	40 CFR 264.600, et seq. Subpart X		Yes/No	Applicable if alternative involves on-site treatment in a miscellaneous unit.
Standards for the Management of Specific Hazardous Waste and Specific Types of Hazardous Waste Management Facilities	40 CFR Part 266	Establishes requirements that apply to recyclable materials that are reclaimed to recover economically significant amounts of precious metals, including gold and silver.	No/No	No alternative is being considered that would involve recycling or reusing hazardous waste.
Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities	40 CFR Part 267	Establishes minimum national standards that define acceptable management of hazardous waste for new land disposal facilities.	No/No	The selected alternative does not involve use of a new land disposal facility; 40 CFR Part 267 standards are not applicable.
Land Disposal Restrictions	40 CFR Part 268	Restricts the land disposal of hazardous waste and specifies treatment standards that must be met before these wastes can be land	Yes/No	Applicable if the selected alternative involves placement of waste from outside the area of contamination, if waste is removed, treated, and

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
		disposed.		redeposited into the same or another unit. A treatability variance may also be applicable.
Hazardous Waste Permit Program	40 CFR Part 270	Establishes provisions covering basic EPA permitting requirements.	No/No	Permits are not required for on-site CERCLA response actions. Substantive requirements of 40 CFR 264 may be applicable.
Occupational Safety and Health Act	29 U.S.C. §§ 651-678	Regulates worker health and safety.	No/Yes	Applies to all response activities under the NCP. (Superceded by CAL-OSHA.)
Hazardous Material Transportation Act	49 U.S.C. §§ 1801-1813			
Hazardous Materials Transportation Regulations	49 CFR Parts 107, 171-177	Regulates transportation of hazardous materials.	Yes/No	Applicable if waste is shipped off site.
National Historic Preservation Act	16 U.S.C. § 470 40 CFR 6.301(b) 36 CFR Part 800	Requires federal agencies to take into account the effect of any federally assisted undertaking or licensing on any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places.	No/No	No district, site, building, structure, or object will be affected that is included in or eligible for the National Register of Historic Places.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Archaeological and Historic Preservation Act	16 U.S.C. § 469 40 CFR 6.301(c)	Establishes procedures to provide for preservation of historical and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	No/No	No historical or archaeological data will be affected.
Historic Sites, Buildings, Objects, and Antiquities	16 U.S.C. §§ 461-467 40 CFR 6.301(a)	Requires federal agencies to consider the existence and location of landmarks on the National Registry of Natural Landmarks to avoid undesirable impacts on such landmarks.	No/No	No natural landmarks will be affected.
Fish and Wildlife Coordination Act	16 U.S.C. §§ 661-667	Requires consultation when federal department or agency proposes or authorizes any modification of any stream or other water body and requires adequate provision for protection of fish and wildlife resources.	Yes/No	F & W Services have been notified. The full extent of this ARAR will be evaluated in the FS for the Wetland Operable Unit.
Endangered Species Act	16 U.S.C. 1531-1536 50 CFR Part 402	Requires action to conserve endangered species within critical habitats upon which endangered species depend; includes consultation with Department of Interior.	Yes/No	The clapper rail and salt marsh harvest mouse are endangered species that inhabit tidal lands surrounding the site. Evaluation of this ARAR will be conducted in the FS for the Wetland Operable Unit.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Clean Water Act	33 U.S.C. §§ 1251-1376			
Dredge or Fill Requirements (Section 404)	40 CFR Parts 230, 231	Requires permits for discharge of dredged or fill material into navigable waters.	No/No	There may be discharge of dredged or fill materials into navigable waters as part of remediation of the Wetland Operable Unit.
Protection of Navigable Waters and of Harbor and River Improvements Generally	33 U.S.C. § 403			
General Regulatory Policies - Department of the Army Corps of Engineers	33 CFR Parts 320-330	Requires permit for structures or work in or affecting navigable waters.	No/No	No activities in this operable unit will discharge dredged or fill materials into navigable waters of the U.S.
Executive Order, Protection of Wetlands	Exec. Order 11990 40 CFR §6.302(a) and Appendix A	Requires federal agencies to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practical alternative exists.	No/No	This will be evaluated in the FS for the Wetland Operable Unit.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Executive Order, Floodplain Management	Exec. Order 11988	Requires federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid adverse impacts associated with diret and indirect development of a floodplain.	Yes/No	Zone was defined as a 100-year shallow flooding area. The 100-year flood is not expected to affect the site under post-project conditions.
National Wilderness Preservation System	16 U.S.C. § 1131 50 CFR § 35.1	Establishes the national system of wilderness areas, including a policy for protecting and managing these areas. It prohibits certain activities within wilderness areas.	No/No	There are no wilderness areas on or adjacent to the site.
National Wildlife Refuge System Administration Act	16 U.S.C. § 668dd 50 CFR § 27	Restricts activities within a National Wildlife Refuge.	No/No	There are no wildlife refuge areas on or adjacent to the site.
Wild and Scenic Rivers Act	16 U.S.C. § 1271 40 CFR § 6.302(e)	Prohibits adverse effects on scenic rivers.	No/No	There are no designated wild or scenic rivers on or adjacent to the site.
<u>State Requirements, Criteria, or Limitations</u>				
Coastal Zone Management Act	16 U.S.C. § 1451	Governs activities in the coastal zone.	No/No	No activities in this operable unit will occur within the coastal zone.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Air Resources Act	Health & Safety Code, Div. 26, Sec. 39000 et seq. 17CCR, Part III, Chapter 1, Sec. 6000 et seq.	Regulates both non-vehicular and vehicular sources of air contaminants in California. Defines relationship of the California Air Resources Board (ARB) and local or regional air pollution control districts (APCDs). Establishes Ambient Air Quality Standards.	Yes/No	The Act is implemented primarily through the APCDs for stationary sources.
Bay Area Management Pollution Control District Rules and Regulations	Pollution Control District Rules and Regulations	Rules and regulations pertain to stationary sources of air emissions. Rules address prohibition of visible emissions; incinerator standards; nuisance, and compliance with PSD, NESHAPs, NSPS, and ambient air emission standards.	Yes/No	Substantive requirements applicable to alternatives that have the potential to emit air pollutants.
Air Toxics "Hot Spots" Information and Assessment Act	Health & Safety Code, Chapter 1252 Stats 1987 Sec. 44300 et seq.	Requires operators of facilities emitting more than a specified level of pollutants to perform an assessment of those emissions. Certain facilities, as prioritized by the air district, will need to perform a risk assessment.	Yes/No	Substantive requirements are not applicable to activities considered in the proposed alternatives.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
California Safe Drinking Water Act	Health & Safety Code, Div. 5, Part 1, Chapter 7, Sec. 4010 et seq.	Regulations governing public water systems; provides for drinking water quality standards - Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs).	No/Yes	MCLs are acceptable concentration limits from a "free flowing cold water outlet of the ultimate user." To apply this standard as a cleanup level for groundwater means that the law, and the standard, is "relevant and appropriate."
	22 CCR, Div. 4, Chapter 15, Sec. 64401 et seq.	Establishes primary and secondary drinking water standards for public water systems.		
Porter Cologne Water Quality Control Act	Water Code, Div. 7, Sec. 13000 et seq.	Identifies general duties and authorities of state and regional water boards, including preparation of a Basin Plan and enforcement of water quality regulations.	Yes/No	The San Francisco Bay Regional Water Quality Control Board will be involved in setting cleanup goals for contaminated soil and groundwater and for establishing acceptable conditions for reinjection. The Region 2 Basin Plan includes limitations on surface water discharges. It adopts State Board Resolutions 68-16, which applies to maintaining water quality; 88-63, which sets criteria for groundwater to be considered a drinking water source; and Regional Board Resolution 88-160, which applies to disposal of extracted groundwater from groundwater remediation projects. RWQCB Order No. 91-016 requires that remediation plans be

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
				developed for the site.
	23 CCR, Div. 3:			
	- Chapter 9, Sec. 2200 et seq.	Waste Discharge Reports and Requirements.	Yes/Yes	Substantive requirements may apply.
	- Chapter 9.1, Sec. 2240 et seq.	Enforcement Procedures for Cease and Desist Orders.	No/No	These are administrative requirements, not ARARs.
	- Chapter 10, Sec. 2300 et seq.	Licensing and Regulation of Use of Oil Spill Cleanup Agents	No/No	Oil spill cleanup agents are not part of potential alternatives.
	- Chapter 15, Sec. 2510 et seq.	Discharge of Waste to Land. Regulations establishing waste and site classifications and waste management requirements for waste treatment, storage, or disposal in landfills, surface impoundments, waste piles, and land treatment facilities.	Yes/Yes	Substantive requirements may be applicable or relevant and appropriate if alternative involves use of new landfill. No alternatives involve the use of new landfills.
	- Chapter 16, Sec. 2610 et seq.	Underground Tank Regulations. New and existing UST construction, monitoring, repairs, releases of substances, and closure.	No/No	There are no underground tanks to be remediated.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Water Well Standards, State of California	Bulletin 74-81	The standards are intended to apply to the construction and major reconstruction or destruction of water wells.	Yes/No	Well construction, abandonment, and destruction will comply with these standards.
California Hazardous Waste Control Laws	Health & Safety Code, Div. 20, Chapter 65, Sec. 25100, et seq.	Regulations governing hazardous waste control; management and control of hazardous waste facilities; transportation; laboratories; classification of extremely hazardous, hazardous, and nonhazardous waste.	Yes/Yes	
	22 CCR, Div. 4 Chapter 30, Sec. 66001 et seq.	Minimum standards for management of hazardous and extremely hazardous waste.	Yes/Yes	
Safe Drinking Water & Toxics Enforcement Act of 1986 ("Proposition 65")	Health & Safety Code, Div. 20, Chapter 6.6, Sec. 26249.5 et seq.	Provides protection of drinking water by prohibiting any detectable discharge of certain listed carcinogens and reproductive toxicants. Requires warnings to be given when any exposure to the chemicals (regulated under the Act) is anticipated.	No/No	Provisions apply only to certain listed chemicals and to persons in the course of doing business. Additionally, the treated water is returned to the same source or water supply.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
California Hazardous Substance Account Act/Hazardous Substances Cleanup Bond Act	Health & Safety Code, Div. 20, Chapter 6.8, Sec. 25300 et seq.	Establishes a program to provide for response authority for releases of hazardous substances; compensation for injuries resulting from exposure to release of hazardous substances; and adequate matching funds for CERCLA actions.	Yes/No	
Hazardous Materials Release Plans and Inventory Requirements	Health & Safety Code, Div. 20, Chapter 6.95, Sec. 25500 et seq. 19 CCR, Chapter 2, Subchapter 3, Sec. 2620 et seq.	Reporting requirements for a release or threatened release of a hazardous material. Sets requirements for "Area Plans"; "Business Plans"; the Acutely Hazardous Materials Registration form; and the Risk Management and Prevention Program.	No/No	Not an ARAR for CERCLA activities.
Environmental Quality Assessment Requirements	Health & Safety Code, Div. 20, Chapter 6.98, Sec. 25570 et seq.	Requirements and procedures for preparation of environmental quality assessments (environmental audits).	No/No	Not an ARAR for CERCLA activities.
Hazardous Substances Act	Health & Safety Code, Div. 22, Chapter 13, Sec. 28740 et seq.	Provides definitions of "hazardous substance" and "toxic."	Yes/No	Applicable to hazardous substances identified in the code.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
California Environmental Quality Act (CEQA)	Pub.Res. Code, Div. 13	Provides for the environmental review of discretionary actions.	No/No	Substantive requirements will be met via the Ecological Assessment being conducted for the Wetland Operable Unit.
	14 CCR, Div. 6, Sec. 15000 et seq.	Guidelines for implementation of CEQA, including responsibilities of public agencies, lead agencies, initial studies, negative declaration declaration process, EIR process, time limits, contents, review, and approval.		The RWQCB is categorically exempt from preparing EIRs for remediation projects.
Fish and Game Regulations on Pollution	Fish and Game Code, Div. 6, Part 1, Chapter 2, Sec. 5650 et seq.	Codifies the prohibition of water pollution with any substance or material deleterious to fish, plant life, or bird life.	No/No	Not an ARAR for the upland FS. Will be an ARAR for the wetland operable unit.
California Highway Patrol Hazardous Material	Cal. Vehicle Code § 32000 et seq.; 13 CCR § 1160 et seq.		Yes/No	May be applicable to transportation of hazardous materials from the site.
Hazardous Waste Movement Committee Memorandum of Understanding	An agreement made on November 8, 1983, by the DHS, Caltrans, and CHP	An agreement between the Departments of Health Services, Transportation (Caltrans), and California Highway Patrol to coordinate with each other for the transportation of large quantities of	No/No	If selected alternative involves off-site transport of large quantities of hazardous waste, may have to be complied with. Not an ARAR because it applies to off-site activities.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
		hazardous wastes excavated from abandoned sites.		
California Occupational Health and Safety Act	Labor Code, Div. 5, Sec. 6300 et seq.	Regulations to assure safe and healthy working conditions by authorizing the enforcement of standards and procedures.	Yes/No	Worker health and safety is regulated primarily by CAl-OSHA, which generally supercedes federal OSHA.
	8 CCR, Chapter 4: Subchapter 4, Sec. 1500 et seq.	A detailed analysis of construction safety regulations.		
	Subchapter 5, Sec. 2300 et seq.	A detailed analysis of electrical safety regulations.		
	Subchapter 7, Sec. 3200 et seq.	A detailed analysis of general industrial safety regulations, including procedures, equipment, and structures.		
Criteria for Identification of Hazardous and Extremely Hazardous Wastes Threshold Limit Concentrations	22 CCR, Div. 4, Chapter 30, Art. 11, Sec. 66693-66747	Promulgated criteria to evaluate whether a material is hazardous. Includes Soluble Threshold Limit Concentration (STLC) and Total Threshold Limit Concentration (TTLC).	Yes/No	STCL and TTLC chemical-specific values reflect the chemical characteristics of persistence and bioaccumulation. The limits are not health-based.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Water Quality Objectives	RWQCB Criteria	Promulgated criteria setting chemical-specific concentration levels for a variety of uses of specific bodies of water. Based on the beneficial uses of specified water bodies.	Yes/No	Regional Water Quality Control Objectives are identified in the Water Quality Control Plan Reports (Basin Plans) of the nine Regional Water Quality Control Boards. May be applicable if groundwater is reinjected.
Underground Storage of Hazardous Substances Requirements	Health & Safety Code, Div. 20, Chapter 6.7, Sec. 25280 et seq.	Regulations governing the testing, monitoring, and replacing of underground storage tanks.	No/No	No underground tanks will be remediated or installed.
California Coastal Act of 1976	Pub. Res. Code, Div. 20, Sec. 30000 et seq.	Governs activities in the coastal zone.	No/No	No activities will be performed in the coastal zone in this operable unit.
McAteer-Petris Act of 1969 (BCDC)	Title 14 Administrative Code, Sec. 66600 et seq.	Provides permit authority over any construction within 100 feet of tidal waters of San Francisco Bay and in tidal waters.	No/No	Does not apply to the upland operable unit. Will be an ARAR for the wetland operable unit.
Federal and State Criteria, Advisories, and Guidance to be considered				
National Secondary Drinking Water Standards	40 CFR Part 143	Secondary maximum contaminant levels (SMCLs). Standard to control chemicals in drinking water that primarily affects the aesthetic qualities relating to public acceptance of drinking water.		Secondary standards are not federally enforceable; intended as guidelines for the states. SMCLs are not ARARs unless promulgated by state.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
National Secondary Drinking Water Standards	40 CFR Part 143	Secondary maximum contaminant levels (SMCLs). Standard to control chemicals in drinking water that primarily affects the aesthetic qualities relating to public acceptance of drinking water.		Secondary standards are not federally enforceable; intended as guidelines for the states. SMCLs are not ARARs unless promulgated by state.
National Maximum Contaminant Level Goals	Pub. L. 99-339, 100 Stat. 642 (1986)	Establishes drinking water quality goals (MCLGs), at levels of no known or anticipated adverse health effects with an adequate margin of safety. MCLGs do not take cost or feasibility into account. Under SDWA, MCLGs are goals, not enforceable standards.		
Water Quality Standards	40 CFR Part 131	Nonenforceable criteria for water quality to protect human health and aquatic life. From the water quality criteria, states adopt water quality standards that protect a designated use. A water quality standard defines the water quality goals of a water body through use of designations and criteria to protect the designated uses.		CERCLA requires that the remedy selected must require a level or standard of control that at least attains water quality criteria established under Section 304 or 303 of the Clean Water Act. CERCLA also states "in determining whether or not any water quality criteria...is relevant and appropriate...the President shall consider the designated or potential use of the surface or ground water, the environmental media affected, the purposes for which the criteria were

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
				developed, and the latest information available."
Media Cleanup Standards (MCSs) (proposed)	55 FR 30798 Sec. 264.525	Proposed amendment to RCRA regulations. MCSs are established at concentrations that ensure protection of human health and the environment. Standards are set for each medium during the remedy selection process.		The regulations are proposed and therefore TBCs. When promulgated, the standards are potential ARARs.
<u>Other Potential Federal and State Criteria, Advisories, and Guidance to be Considered</u>				
Health Advisories	EPA and National Academy of Sciences	Health advisories developed for short-term, long-term, and lifetime exposures. The advisories are considered to be guidance and are not enforceable.		
Corrective Action for Solid Waste Management at Hazardous Waste Management Facilities	40 CFR 264.500 - 264.560, Subpart S (proposed)	Proposed rule establishes procedures and technical requirements for implementing corrective action under Section 3004(u) of RCRA. The regulations define requirements for conducting remedial investigations, evaluating potential remedies, and selecting and implementing remedies at RCRA facilities.		Provisions of the proposed rule (e.g., media cleanup standards, conditional remedies) must be addressed as TBCs.

TABLE 7.1

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS UPLAND OPERABLE UNIT

Statue or Regulation	Citation	Description	Applicable/ Relevant and Appropriate	Comments
Site-Specific Health-Based Goals	(PRC, 1991)	Conservative concentration goals for carcinogens and non-carcinogens in soil.		

8.0 DESCRIPTION OF ALTERNATIVES

Rhone Poulenc submitted a final Remedial Investigation Report dated September 19, 1989, draft Feasibility Studies dated August 1989, July 30, 1991 and a final FS report dated November 1, 1991. The reports contain the results of the subsurface investigation, a description of the groundwater and soil contamination, and an evaluation of the interim cleanup actions, and remedial alternatives. EPA and the Regional Board staff determined that the technical information contained in the RI/FS was acceptable for developing a final cleanup plan.

EPA and the Regional Water Quality Control Board evaluated remedial action alternatives for the Rhone Poulenc site in accordance with CERCLA Section 121, the National Contingency Plan ("NCP"), and the Interim Guidance on Superfund Selection of Remedy, December 24, 1986 (Oswer Directive No. 9355.0-19).

The Feasibility Study initially screened approximately 34 soil and 45 groundwater remedial action technologies. These technologies were screened based on implementability, effectiveness, and cost criteria. The remedial technologies that survived the screening were assembled into the group of alternatives listed below.

Remedial Alternative A

For this alternative, no action (other than groundwater monitoring) would be performed on the Sandoz and surrounding properties in the upland operable unit.

The components of Alternative A are listed below.

1. Remedial Alternative A is a "no further action" alternative, retained for base-line comparison purposes in accordance with CERCLA/SARA guidance. Except for groundwater monitoring remedial technologies are not implemented at the site under this alternative.

Total present worth cost = $900,000

Remedial Alternative B

This alternative was developed to prevent exposure to affected soil and contain contaminanted groundwater. The alternative includes paving, future soil excavation, deed restrictions, and groundwater monitoring with future groundwater contingency plans outlined. Each property in the upland operable unit, except for Sandoz and Bains, would be remediated by either (1) excavating soil having arsenic concentrations greater than 70 mg/kg, or (2) paving areas where soil arsenic concentrations

exceed 70 mg/kg and obtaining deed restrictions. The unpaved portions of the Sandoz property and the Bains property containing arsenic concentrations greater than 70 mg/kg would be paved, and deed restrictions would be applied to both properties.

The total mass of arsenic affected by site activities is 74,800 kg and the total volume of soils affected (> 20 mg/kg As) is 91,000 yd^3. The early action excavation removed 2260 yd^3 of soil and 20,000 kg of arsenic. The additional excavation that would occur after the facility ceases operation would remove 1260 yd^3 of soil and 10,000 kg of arsenic. Alternative B does not include treatment of contaminated soil. The volume of soil that would be removed in Alternative B is 4% of the contaminated soil in the upland operable unit and 40% of the mass of arsenic once the future removal occurs. Under this alternative approximately 86% of the contaminated soil or 44,800 kg of As would be left on site. The slurry wall would contain 43,200 kg of As within its boundaries.

Remedial Alternative B consists of the following:

1. Surface Cap and Deed Restrictions for Sandoz and Bains properties.

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (accessible areas occured during September 1991). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties would be removed when the facility ceases operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/ks As) on all properties except for Sandoz and Bains. Deed restrictions will be obtained for properties where paving is selected.

4. Groundwater Monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The contingency plan allows for groundwater extraction and treatment if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

5. Installation of Slurry wall with dewatering. The installation of the slurry wall would only occur if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or

that the arsenic concentration in the deep aquifer exceeds background levels. The slurry wall would surround the area containing contaminated soil and ground water remaining after soil remediation. It would enclose 76,800 yd^3 of soil (84% of the contaminated soil in the upland operable unit) and 43,200 kg of arsenic (58% of the arsenic). Groundwater extraction and treatment within the slurry wall is necessary to maintain the inward hydraulic gradient across the slurry wall. In order to estimate pumping rates and volumes, calculations were based on a 30 year project life. Therefore, if the dewatering system operated at a pumping rate of 2 gpm for 30 years it would remove 3.2×10^7 gallons of water.

6. Installation of three additional deep aquifer monitoring wells as outlined in the "Deep Aquifer Monitoring Plan".

Total present worth cost = $5,800,000

Remedial Alternative C

This alternative is the same as Alternative B, except that a groundwater extraction and treatment system, instead of a slurry wall, would be installed to contain contaminated groundwater in the shallow groundwater zone. This extraction system would only be installed if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or if the arsenic concentration in the deep aquifer exceeds background levels. Using 30 years as an estimate, the pumping rate of the extraction system would be 25 gallons per minute, and would remove 3.9×10^8 gallons of water during this time period. The total volume of sludge that would be generated during this 30 year timeframe would be 23,000 tons. Extracted groundwater would be treated and discharged to the local storm drain under an NPDES permit.

The volume of soil that would be removed in Alternative C is 4% of the contaminated soil in the upland operable unit and 40% of the mass of arsenic once the future removal occurs. Under this alternative approximately 98% of the contaminated soil and 60% of the mass of As would be left on site.

Remedial Alternative C consists of the following:

1. Deed restrictions for Sandoz and Bains properties

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (accessible areas occured during September 1991). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties would be removed when the facility ceases

operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/kg As) on all properties except for Sandoz and Bains. Deed restrictions will be obtained for properties where paving is selected.

4. Groundwater Monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The contingency plan allows for groundwater extraction and treatment if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

5. Extraction and treatment of contaminated groundwater. Extraction and treatment of contaminated groundwater in the shallow zone will commence should the arsenic concentrations in the perimeter monitoring wells approach the MCL of 50 ppb. A precipitation/ microfiltration process was identifed as the best available method for treating extracted groundwater. Bench-scale study results indicate that arsenic concentrations could be reduced sufficiently to permit water reuse, reinjection, discharge to the public sewer system or discharge to the storm sewer. This contingency plan for groundwater can best be described as follows:

    a. If concentrations in any perimeter monitoring well exceed 30 ppb, the sampling frequency will increase from annually to semi-annually.

       A concentration of 40 ppb is designated as the "trigger" level for implementing a mitigation response for the perimeter monitoring wells. The Aquifer Characterization and Contingency Plan describes corrective action measures in detail.

6. Installation of three additional deep aquifer monitoring wells as outlined in the "Deep Aquifer Monitoring Plan".

Total present worth cost = $6,200,000

Remedial Alternative D

Alternative D is the same as Alternative B except that it includes an innovative technology, treating arsenic soil via silicate fixation. Treatability studies have been performed contaminated soils and the resullts are documented in the "Early Action Removal Report". This alternative would treat soils containing arsenic concentrations greater than 1000 mg/kg, which corresponds to approximately 28,700 kg of arsenic and 11,000 yd^3 of contaminated soil. The upland unit contains approximately 6,600 yd^3 of contaminated soil with concentrations greater than 1000 mg/kg beneath structures on the Bains and Sandoz properties. This soil would be removed and treated at a future date. Approximately 4400 yd^3 of soil within the Upland Operable unit would be treated within the year. Under this remedy 38% of the total mass of the arsenic would be eventually treated(41% of 28,700 kg As within a year, and 58% of 28,700 kg As in the future). As in alternative B the slurry wall would contain 43,200 kg of As or 84% of contaminated soil by volume.

Remedial Alternative D consists of the following:

1. Surface Cap and Deed Restrictions for Sandoz and Bains properties

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (removal in accessible areas occured during September 1991). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties would be removed when the facility ceases operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/ks As) on all properties except for Sandoz and Bains. Deed restrictions will be obtained for properties where paving is selected.

4. Treatment of soils containing arsenic concentrations greater than 1000 mg/kg As via silicate stabilization method (accessible areas to occur within next year and soils beneath buildings in the future when buildings removed).

5. Groundwater Monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The contingency plan allows for groundwater extraction and treatment if statistically significant evidence shows that any one of the

perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

6. Installation of Slurry wall with dewatering. The installation of the slurry wall would only occur if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels. The slurry wall would surround the area containing contaminated soil and ground water remaining after soil remediation. It would enclose 76,800 yd^3 of soil (84% of the contaminated soil in the upland operable unit) and 43,200 kg of arsenic (58% of the arsenic). Groundwater extraction and treatment within the slurry wall is necessary to maintain the inward hydraulic gradient across the slurry wall. In order to estimate pumping rates and volumes, calculations were based on a 30 year project life. Therefore, if the dewatering system operated at a pumping rate of 2 gpm for 30 years it would remove 3.2×10^7 gallons of water.

7. Installation of three additional deep aquifer monitoring wells as outlined in the "Deep Aquifer Monitoring Plan".

Total present worth cost = $7,800,000

Remedial Alternative E

Alternative E is the same as Alternative D, except it includes an innovative technology, treating arsenic soil via silicate fixation and installation of a slurry wall after the Wetland ROD is signed. This alternative would treat soils containing arsenic concentrations between 500 and 5000 mg/kg of arsenic. This corresponds to 20,000 yd^3 of contaminated soil which contains approximately 37,600 kg of arsenic. The upland unit contains approximately 12,200 yd^3 of contaminated soil with concentrations greater than 500 mg/kg beneath structures on the Bains and Sandoz properties. This soil would be removed and treated at a future date. Approximately, 7,600 yd^3 of contaminated soil within the Upland Operable unit would be treated within the year. Under this remedy 50% of the total mass of the arsenic would be eventually treated(40% of 37,600 kg As within a year, and 60% of 37,600 kg As in the future). The combined initial and future phases of fixation will result in the treatment of 22% of the contaminated soil. As in alternative B the slurry wall would contain 43,200 kg of As or 84% of contaminated soil by volume.

Remedial Alternative E consists of the following:

1. Surface Cap and Deed Restrictions for Sandoz and Bains properties

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (asessible areas occured during September 91). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties would be removed when the facility ceases operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/ks As) on all properties except for Sandoz and Bains. Deed restrictions will be obtained for properties where paving is selected.

4. Treatment of soils containing arsenic concentrations greater than 500 mg/kg As via silicate stabilization method (accessible areas to occur within next year and soils beneath buildings in the future when buildings removed).

5. Groundwater Monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The contingency plan allows for groundwater extraction and treatment if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

6. Installation of Slurry wall with dewatering. The slurry wall would surround the area containing contaminated soil and ground water remaining after soil remediation. It would enclose 76,800 yd^3 of soil (84% of the contaminated soil in the upland operable unit) and 43,200 kg of arsenic (58% of the arsenic). Groundwater extraction and treatment within the slurry wall is necessary to maintain the inward hydraulic gradient across the slurry wall. In order to estimate pumping rates and volumes, calculations were based on a 30 year project life. Therefore, if the dewatering system operated at a pumping rate of 2 gpm for 30 years it would remove 3.2×10^7 gallons of water and generate 1900 tons of sludge.

7. Installation three additional deep aquifer monitoring wells. The goal would be to have a minimum of three well pairs that would monitor the upper shallow zone, the lower shallow zone, and the deep aquifer zone.

8. Installation of a cap and liner.

Total present worth cost = $9,100,000

Remedial Alternative F

Alternative F is the same as Alternative E except that it substitutes groundwater extraction and treatment in place of the slurry wall installation. The volume of soil and mass of arsenic impacted would be exactly the same as those numbers denoted in Alternative E. Using 30 years as an estimated project life, the system would operate at a pumping rate of 25 gpm, remove 3.9 x 108 gallons of water, and generate 23,000 tons of sludge from the complete removal of TDS from this water.

Remedial Alternative F consists of the following:

1. Deed restrictions for Sandoz and Bains properties

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (asessible areas occured during September 91). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties would be removed when the facility ceases operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/ks As) on all properties except for Sandoz and Bains. Deed restrictions will be obtained for properties where paving is selected.

4. Treatment of soils containing arsenic concentrations greater than 500 mg/kg As via silicate stabilization method (accessible areas to occur within next year and soils beneath buildings in the future when buildings removed).

5. Groundwater Monitoring

6. Extraction and treatment of contaminated groundwater. Extraction and treatment of contaminated groundwater in the shallow zone will commence should the arsenic concentrations in the perimeter monitoring wells approach the MCL of 50 ppb. A precipitation/ microfiltration process was identifed as the best available method for treating extracted groundwater. Bench-scale study results indicate that arsenic concentrations could be reduced sufficiently to permit water reuse, reinjection, discharge to the public sewer system or discharge to the storm sewer. This contingency plan for groundwater can best be described as follows:

   A. If concentrations in any perimeter monitoring well exceed 30 ppb, the sampling frequency will increase from annually to semi-annually.

   B. A concentration of 40 ppb is designated as the "trigger" level for implementing a mitigation response for the perimeter monitoring wells. The Aquifer Characterization and Contingency Plan describes corrective action measures in detail.

7. Installation of three additional deep aquifer monitoring wells as outlined in the "Deep Aquifer Monitoring Plan".

Total present worth cost = $9,500,000

Remedial Alternative G

This alternative was developed to minimize long-term management of the site. Soil containing arsenic concentrations above background, or greater than 20 mg/kg would be removed from the Sandoz and surrounding properties. Contaminated groundwater in the shallow zone would be removed during the excavation and groundwater monitoring would continue to be performed. The dewatering process would remove 50 million gallons of water during the excavation period and generate 3000 tons of sludge.

The early action removed 2260 yd^3 of soil and 20,000 kg of arsenic. This remedy would result in excavation of an addtional 89,580 yd^3 of soil and 76,900 kg of arsenic. The proposed soil treatment via silicate fixation would be performed in ensure that the soil leachability values would meet land ban requirements. Implementation of this remedy would be completed within six years of the excavation start date. Alternative G would result in the removal of 100% of the contaminated soil and 100% of the arsenic in the upland operable unit.

Remedial Alternative G consists of the following:

1. Remove all soils with arsenic concentrations greater than 20 mg/kg. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (accessible areas occured during September 1991).

2. Groundwater Monitoring

3. Installation of three additional deep aquifer monitoring wells as outlined in the "Deep Aquifer Monitoring Plan".

Total present worth cost = $85,000,000

TABLE 8.1

ESTIMATED COSTS OF ALTERNATIVES
UPLAND OPERABLE UNIT
1990 Bay Road Site
East Palo Alto, California

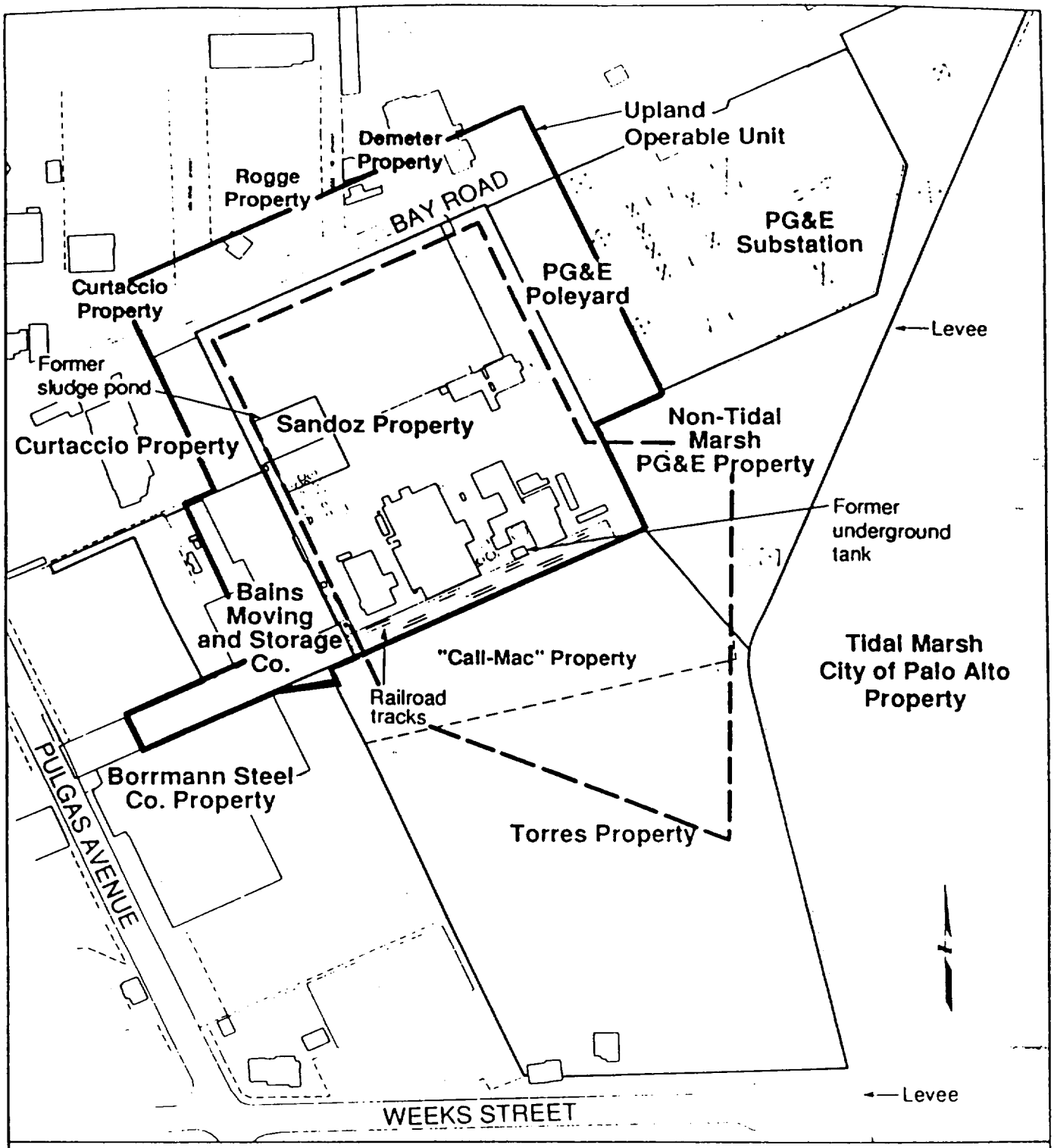
(Costs in $ millions)

	Alternative						
Capital Costs:	A	B	C	D	E	F	G
Design Engineering:	0	0.3	0.3	0.5	0.6	0.6	13
Construction Costs:	0	1.3	1.3	1.9	2.3	2.3	48
Construction Contingencies:	0	0.4	0.4	0.6	0.8	0.8	17
Services During Construction:	0	0.2	0.2	0.3	0.3	0.3	6
Total Capital Costs:	0	2.2	2.2	3.3	4.0	4.0	84
Present Value (PV) of Future Costs[1] (5% rate of return):							
PV of Operations and Maintenance (Years 1 to 30):	0.9	1.1	1.1	1.1	1.1	1.1	1.1
PV of Future Remediation:	0	2.5	2.9	3.5	4.1	4.5	0
Total Present Value of Future Costs: (PVFC)	0.9	3.6	4.0	4.6	5.2	5.6	1.1
-30%	0.6	4.1	4.3	5.5	6.4	6.6	60
Net Present Value (Capital Costs plus PVFC):	0.9	5.8	6.2	7.8	9.1	9.5	85
+50%	1.4	8.7	9.3	12	14	14	128

Notes:
1. Cost estimates assume that deferred remediation, including excavation, treatment, paving, and groundwater containment, would be implemented in 15 years.

2. Detailed cost data and methodology presented in Appendix E.

FEAS\COST.TBL



KEY

— — — Proposed slurry wall location

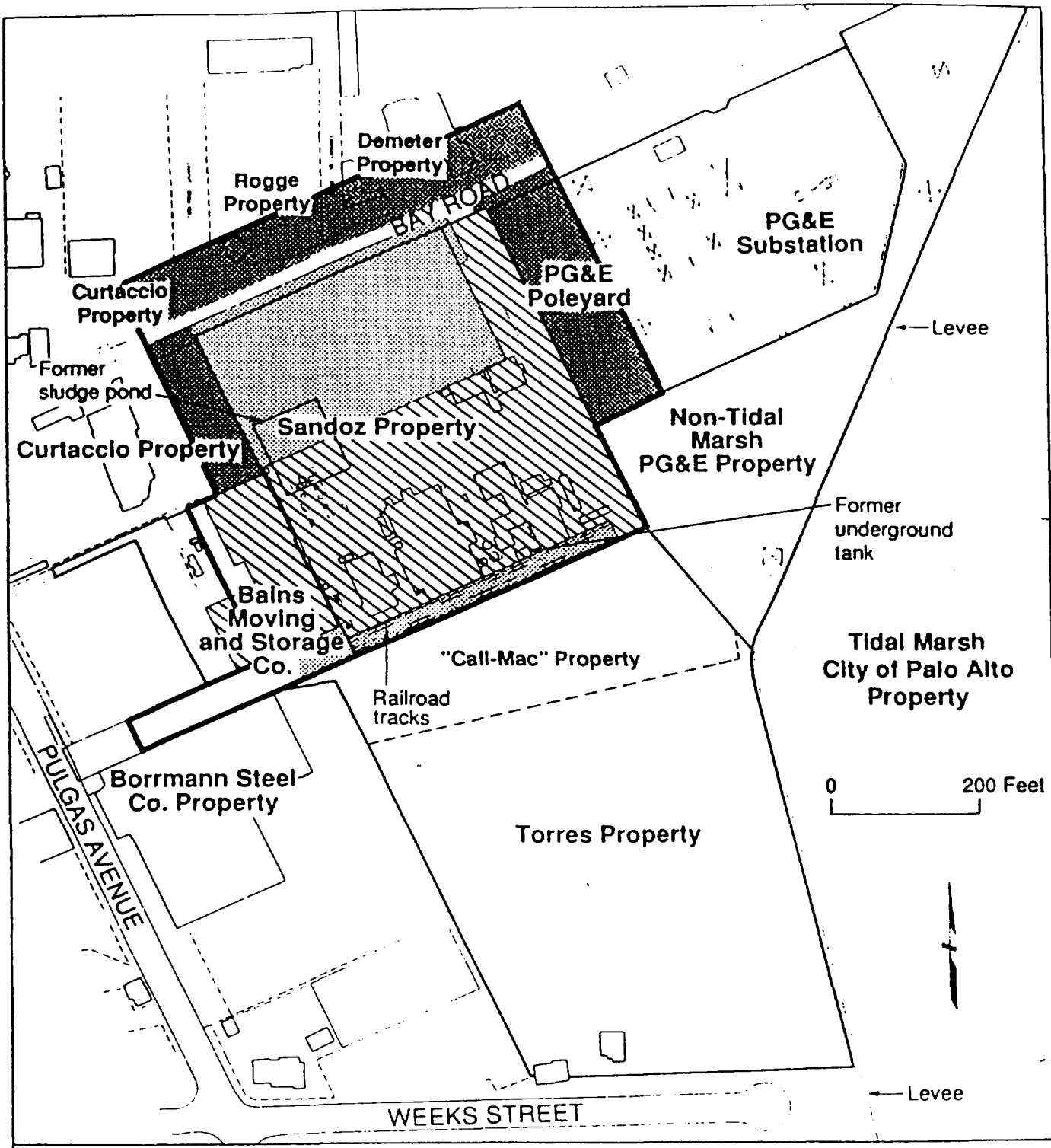
0 200 Feet

GEOMATRIX

PROPOSED SLURRY WALL LOCATION
1990 Bay Road Site
East Palo Alto, California

Figure
8.1

Project No
1220F



EXPLANATION

- Currently unpaved areas to be paved under Alternatives B through F (includes deed restrictions on properties)
- Inaccessable areas in Upland Operable Unit to be remediated in the future under Alternatives B through F
- Currently unpaved areas where soil with arsenic concentrations in excess of 70 mg/kg will be removed or the deed restricted and the surface paved under Alternatives B through F

GEOMATRIX

PROPOSED REMEDIATION PLAN
UPLAND OPERABLE UNIT
1990 Bay Road Site
East Palo Alto, California

Figure 8.2

Project No 1220F

9.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides an explanation of the criteria used to select the remedy, and an analysis of the remedial action alternatives in light of those criteria, highlighting the advantages and disadvantages of each of the alternatives.

Criteria

The alternatives were evaluated using nine component criteria. These criteria, which are listed below, are derived from requirements contained in the National Contingency Plan (NCP) and CERCLA Sections 121(b) and 121(c).

The alternatives were evaluated in detail with respect to the nine criteria in the FS report. A detailed analysis of the alternatives was completed in the FS. A summary of this detailed analysis is shown on Table 9.1.

1. Overall protection of human health and the environment. This criterion addresses whether a remedy provides adequate protection of human health and the environment.

2. Compliance with applicable or relevant and appropriate requirements (ARARs). This criterion addresses whether a remedy will meet all of the ARARs or other Federal and State environmental laws.

3. Long-term effectiveness and permanence. This criterion refers to expected residual risk and residual chemical concentrations after cleanup standards have been met and the ability of a remedy to maintain reliable protection of human health and the environment over time.

4. Reduction of toxicity, mobility or volume through treatment. This criterion refers to the anticipated performance of the treatment technologies a remedy may employ.

5. Short-term effectiveness. This criterion addresses the period of time needed to achieve cleanup and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup standards are achieved.

6. Implementability. This criterion refers to the technical and administrative feasibility of a remedy.

7. Cost. This criterion includes estimated capital and operation and maintenance, usually presented in a 30 year present worth format.

8. Support Agency Acceptance This criterion addresses EPA's acceptance of the selected remedy and any other EPA comments.

9. Community Acceptance This criterion summarizes the public's general response to the alternatives.

9.1 Groundwater and Soil

Threshold Criteria

Overall protection of human health and the environment

Alternatives D, E, F and G would be protective of human health and the environment. Alternatives A, B, and C are not protective of human and health and the environment. The no action alternative and institutional control remedies would not eliminate potential exposure to contaminated soil and groundwater that are present above health-based levels. Alternatives B and C rely on institutional controls which offer protection only if the integrity of the cap is maintained and deed restrictions remain effective. Alternatives D, E, and F have the same components as Alternatives B and C, but these alternatives add silicate fixation as an innovative treatment technology for soils above the health-based levels. Alternative G provides protection of human health and the environment by removing all contaminated soils and groundwater to an off-site disposal facility.

Compliance with applicable or relevant and appropriate requirements

With the exception of Alternatives A, B and C all of the alternatives meet ARARs. Alternatives A, B, and C would not meet 40 CFR Parts 264 and 265. Alternatives B and C would involve removal of characteristic waste and Land Disposal Restrictions would apply. For those alternatives that involve excavation and treatment, health-based cleanup standards for soils were calculated based on TBCs identified for the site (CPFs and RfDs contained in IRIS), and have been selected as soil cleanup standards. Alternatives D, E, and F meet the standards through treatment and containment.

Primary Balancing Criteria

Long-term effectiveness and permanence

Alternative G would provide the greatest level of long-term effectiveness since this alternative entails near-complete removal of contaminated soils and groundwater. This alternative would require almost no long-term monitor-

ing and maintenance, but it would require treatment and disposal of large volumes of soil and sludge at off-site facilities. Alternatives D, E, and F, would provide a high level of long-term effectiveness since they all utilize treatment. Soil fixation and containment of contaminated groundwater within a slurry wall would effectively treat the bulk of site contaminated soil.

Alternatives B, and C offer a moderate level of long-term effectiveness since they rely on continued and proper maintenance of the cap and institutional controls. Alternatives A and B provide little protection against exposure to contaminated soils and groundwater.

Reduction of toxicity, mobility, or volume through treatment

Reductions in toxicity, mobility, or volume of contaminants in the upland operable unit are achieved primarily by reducing the volume of soil through removal, treatment, and disposal of contaminated soil and groundwater from the site. Reduction in mobility is handled through capping, fixation, and groundwater containment. The mass and volume of contamination removed, treated, and contained by each alternative are presented in Table 9.2. The inherent toxicity of arsenic cannot be reduced effectively by any available treatment technology.

The total volume of contaminated soil in the upland operable unit is estimated to be 91,000 cubic years, which is calculated to contain about 75,000 kg of arsenic. Alternative G would remove the entire volume of contaminated soil. Removal of soils containing arsenic concentrations greater than 5000 mg/kg effectively reduces the mass of arsenic in contaminated soils by about 40% and the volume of contaminated soils by about 4%.

Capping and fixation would reduce mobility of contaminants. Surface capping would also eliminate the emission of contaminated fugitive dust from surface soils and would reduce leaching of contaminants by eliminating surface water infiltration.

Alternatives D, E, and F would result in significant reductions in the mobility and volume of contaminated soil by binding the contaminants to the soil. Results of treatability studies indicate TCLP standards would be met. Soils that are characteristic wastes prior to treatment would no longer be characteristic after treatment. Alternatives E and F would treat approximately 84% of the total mass of arsenic remaining after concentrations greater than 5000 mg/kg have been removed. The mobility of contaminants in groundwater is reduced to very low levels as a result of the groundwater containment and treatment systems. The volume of contaminated groundwater would be reduced by the

groundwater pumping from within the slurry wall. Alternatives A, B, and C would not provide any reduction in contaminant toxicity, mobility, and volume because soils would still contain arsenic concentrations greater than the health-based level (500 ppm).

Short-term effectiveness

Alternatives A would not pose any short-term risks, since access to site is already restricted and this alternative would not disturb contaminated soil. Alternatives B through G pose some short-term risks to community and worker health during implementation due to generation of fugitive dust; however, these risks could be mitigated by the health and safety plan for the site. Offsite transport of contaminated material could cause a threat in the event of an accident during transport.

Implementability

All alternatives are implementable. Alternatives B and C would be easier to implement than Alternatives D, E, and F because they do not involve soil treatment. Alternative D treats a smaller volume of soil than alternatives E and F. Alternative G would remove the greatest volume of contaminants at the site, but would also involve the disruption of a business and destruction of its buildings.

Cost

The cost for the alternatives increases as the volume of treated soil increases. Cost for groundwater extraction is also more expensive than installation of a slurry wall. The cost associated with Alternative A includes groundwater monitoring and is $900,000. Costs for the other alternatives are listed below, and in Table 8.1;

Alternative B	$ 5,800,000
Alternative C	$ 6,200,000
Alternative D	$ 7,800,000
Alternative E	$ 9,100,000
Alternative F	$ 9,500,000
Alternative G	$85,000,000

Table 9.3 lists costs for the selected remedy.

SUPPORT AGENCY ACCEPTANCE

The Feasibility Study and the Proposed Plan Fact Sheet were reviewed by the California Regional Water Quality Control Board (RWQCB). The RWQCB concurs with EPA's preferred alternative.

COMMUNITY ACCEPTANCE

The Proposed Plan was presented to the community of East Palo Alto in a fact sheet and at a public meeting. Comments received are addressed in the Response Summary which is included as an attachment to this ROD.

THE SELECTED REMEDY

Based on an evaluation of the alternatives, the selected remedy for the site is Alternative E. Rhone Poulenc has estimated that it will take approximately 9 months to complete the soil stabilization process at a cost of $9,100,000.

The selected remedy shall consist of the following actions:

1. Surface Cap and Deed Restrictions for Sandoz and Bains properties

2. Removal of soils containing arsenic concentrations greater than 5000 mg/kg (accessible areas occurred during September 91). Soil having high arsenic concentrations in the operating portions of the Sandoz plant and beneath structures on the Sandoz and Bains properties shall be removed when the facility ceases operation and structures are demolished. It is uncertain when remediation would be performed beneath these areas.

3. Removal of soils having concentrations above health-based levels or pave affected areas having soil concentrations above health-based levels (> 70 mg/ks As) on all properties except for Sandoz and Bains. Deed restrictions shall be obtained for properties where paving is selected.

4. Treatment of soils containing arsenic concentrations greater than 500 mg/kg arsenic via silicate stabilization method (accessible areas to occur within next year and soils beneath buildings in the future when buildings removed).

5. Groundwater Monitoring of perimeter wells with a contingency plan for plume containment should further migration occur. The contingency plan requires groundwater extraction and treatment if statistically significant evidence shows that any one of the perimeter wells exceeds 40 ppb of arsenic, or that the arsenic concentration in the deep aquifer exceeds background levels.

6. Installation of Slurry wall with dewatering. The slurry wall shall surround the area containing contaminated soil and ground water remaining after soil remediation. It would enclose 76,800 yd^3 of soil (84% of the contaminated soil in the upland operable unit) and 43,200 kg of arsenic (58% of the arsenic). Groundwater extraction and treatment within the slurry wall is necessary to maintain the inward hydraulic gradient across the slurry wall. In order to estimate pumping rates and volumes, calculations were based on a 30 year project life. Therefore, if the dewatering system operated at a pumping rate of 2 gpm for 30 years it would remove 3.2×10^7 gallons of water and generate 1900 tons of sludge.

7. Installation of three additional deep aquifer monitoring wells. A minimum of three well pairs that would monitor the upper shallow zone, the lower shallow zone, and the deep aquifer zone are required.

8. Installation of a cap and liner.

Total present worth cost = $9,100,000

Remedy Selection Rationale and Statutory Determinations

Threats to human health and the environment posed by the Upland Operable unit, include ingestion of contaminated groundwater, contact with contaminated groundwater, as well as ingestion and inhalation of metals in contaminated soils. The selected remedy for groundwater addresses the threat of exposure by requiring extraction and treatment of contaminated groundwater to regulatory and or background levels should significant horizontal and/or vertical migration occur. The implementation of institutional controls will provide further protection by preventing residential use of the site.

Health-based cleanup levels for soils were calculated based on TBCs for the site, and have been selected as soil cleanup standards. Under the selected remedy for soil, treated soils will only be returned to the ground once they have been stabilized (silicate fixation technology) and meet the performance criteria. For example, they are no longer considered a charac-

teristic waste under TCLP testing. The selected remedy does not involve placement of a restricted waste. EPA has determined that Land Disposal Restrictions do not apply. The selected remedy for soil will involve excavation of a characteristic waste. However, prior to placement, this waste will be treated to levels that do not constitute a characteristic waste, and as a result LDRs will not apply.

The selected remedy addresses the threat of exposure to contaminated soil in several ways. First of all, capping the site and implementing institutional controls removes the threat caused by ingestion and contact with contaminated soils. The selected remedy will attain acceptable carcinogenic risks levels (10^{-4} to 10^{-6}) by eliminating the soil exposure pathway. Treatment of contaminated soils to health-based levels also provides long-term protection from ingestion and inhalation should capping and institutional controls become ineffective at some point in the future. The selected remedy will provide long-term protection within the acceptable risk range since the soil cleanup standards will achieve a carcinogenic risk of 2×10^{-4} and a noncarcinogenic Hazard Index of less than one. Implementation of institutional controls, installing a cap and slurry wall, and performing groundwater monitoring (along with extraction and treatment if necessary) will ensure that the threat of exposure to the deep drinking water aquifer is addressed.

The selected remedy also addresses the threat of exposure to contaminated groundwater in several ways. The selected remedy is effective in the short-term because further plume migration is controlled by installation of the slurry wall. The slurry wall will also require pumping and treating of groundwater to maintain an inward hydraulic gradient. The groundwater extraction and treatment associated with the slurry wall is a permanent solution and significantly reduces pollutant toxicity, mobility and volume in site groundwater. The selected remedy is effective in the long-term by virtue of the fact that ARARs must be met in the deep aquifer, and if contamination in the upper aquifer exceed the 50 ppb in the perimeter wells pumping and treating of groundwater shall commence.

ROD

TABLE 9.1

DOCUMENTATION OF ARARs FOR ALTERNATIVES
UPLAND OPERABLE UNIT
RHONE POULENC/SANDOZ Site
East Palo Alto, California

Statue or Regulation	Alternative A	Alternatives B & C	Alternatives D, E, & F	Alternative G
Federal and State Safe Drinking Water Act, including National Primary Drinking Water Standards and Maximum Contaminant Level Goals (MCLGs)	MCLs in the deep aquifer currently are being met. Alternative A contains no provisions for remediation should the deep aquifer become affected.	MCLs in the deep aquifer currently are being met. These Alternatives contain provisions to implement remedial action should the deep aquifer become affected.	MCLs in the deep aquifer currently are being met. These Alternatives contain provisions to implement remedial action should the deep aquifer become affected.	MCLs currently are being met in the deep aquifer. With removal of nearly all contaminated soil and groundwater at the site, contamination of the deep aquifer is unlikely.
Clean Water Act, including Water Quality Criteria, National Pollutant Discharge Elimination System, and National Pretreatment Standards	An NPDES permit may be required, but this Alternative contains no provisions to meet the NPDES requirements.	An NPDES may be required and, if required, will be obtained for storm water runoff from the Sandoz property and for discharge from a groundwater treatment system.	An NPDES may be required and, if required, will be obtained for storm water runoff from the Sandoz property and for discharge from a groundwater treatment system.	An NPDES permit may be required and, if required, will be obtained for discharge from the groundwater treatment system.
Federal Clean Air Act and State Air Resources Act, including National Primary and Secondary Ambient Air Quality Standards and Bay Area Air Quality Management District Rules and Regulations	Not applicable. No soil is removed in this Alternative.	Excavation will be performed in accordance with air quality regulations issued by the BAAQMD.	Excavation will be performed in accordance with air quality regulations issued by the BAAQMD.	Excavation will be performed in accordance with air quality regulations issued by the BAAQMD.
Hazardous Waste Management Systems General	Not applicable. No waste delisting required in this alternative.	Not applicable. No waste delisting required in this alternative.	Not applicable. No waste delisting required in this alternative.	Not applicable. No waste delisting required in this alternative.
Standards Applicable to Generators of Hazardous Waste	Not applicable. No off-site disposal of hazardous waste in this alternative.	Generator standards will be met for generation and off-site transportation of hazardous waste.	Generator standards will be met for generation and off-site transportation of hazardous waste.	Generator standards will be met for generation and off-site transportation of hazardous waste.

TABLE 9.1

DOCUMENTATION OF ARARs FOR ALTERNATIVES
UPLAND OPERABLE UNIT

Statue or Regulation	Alternative A	Alternatives B & C	Alternatives D, E, & F	Alternative G
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (RCRA), including General Facility Standards; Contingency Plan and Emergency Procedures; Manifest System; Releases from Solid Waste Management Units; Closure and Post-Closure Requirements; Financial Requirements; Use and Management of Containers, Tank Systems, Surface Impoundments, Waste Piles, and Miscellaneous Units; and Land Disposal Restrictions.	Not applicable. No hazardous waste treated, stored, or disposed in this altetnative.	Excavated soil and groundwater treatment residues will be treated and disposed as required by federal regulations.	Excavated soil and groundwater treatment residues will be treated and disposed as required by federal regulations. No permit to perform soil treatment will be required. The substantive requirements of a permit will be satisfied by information in the Remedial Design Report.	Excavated soil and groundwater treatment residues will be treated and disposed as required by federal regulations.
Federal and State Occupational Safety and Health Acts	Site activities will be conducted in accordance with these acts.	Site activities will be conducted in accordance with these acts.	Site activities will be conducted in accordance with these acts.	Site activities will be conducted in accordance with these acts.
Hazardous Material Transportation Act, including Hazardous Materials Transportation Regulations	Not applicable. No soil is removed in this Alternative.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transportation requirements.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transportation requirements.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transportation requirements.
Air Toxics "Hot Spots" Information and Assessment Act	Not applicable. No facilities constructed in this alternative.	Not applicable. No emissions of regulated compounds expected from groundwater treatment facilities.	Not applicable. No emissions of regulated compounds expected from groundwater treatment facilities.	Not applicable. No emissions of regulated compounds expected from groundwater treatment facilities.

TABLE 9.1

DOCUMENTATION OF ARARs FOR ALTERNATIVES
UPLAND OPERABLE UNIT

Statue or Regulation	Alternative A	Alternatives B & C	Alternatives D, E, & F	Alternative G
Porter Cologne Water Quality Control Act	The deep aquifer currently is at background levels. The MCL for arsenic in the shallow aquifer currently is being met in the perimeter network wells. Alternative A contains no provisions to remediate before MCL is reached and no provisions to meet Basin Plan limits for surface water runoff from the site.	The deep aquifer currently is at background levels. The MCL for arsenic in the shallow aquifer currently is being met in the perimeter network wells. These Alternatives contain provisions to implement remedial action before MCL is reached. Basin Plan limits for surface water runoff concentrations will be met.	The deep aquifer currently is at background levels. The MCL for arsenic in the shallow aquifer currently is being met in the perimeter network wells. These Alternatives contain provisions to implement remedial action before MCL is reached. Basin Plan limits for surface water runoff concentrations will be met.	The deep aquifer currently is at background levels. The MCL for arsenic in the shallow aquifer currently is being met in the perimeter network wells. With removal of nearly all contaminated soil and groundwater at the site, it is unlikely that the MCL will ever be reached.
Water Well Standards, State of California	Well construction and abandonment will be performed in accordance with these standards.	Well construction and abandonment will be performed in accordance with these standards.	Well construction and abandonment will be performed in accordance with these standards.	Well construction and abandonment will be performed in accordance with these standards.
California Hazardous Waste Control Laws	Not applicable. No soil is removed in this Alternative.	Excavated soil and groundwater treatment residues will be treated and disposed as required by state and federal regulations.	Excavated soil and groundwater treatment residues will be treated and disposed as required by state and federal regulations. Treated soil replaced on site will require a variance from state hazaradous waste disposal regulations.	Excavated soil and groundwater treatment residues will be treated and disposed as required by state and federal regulations.
California Highway Patrol, Hazardous Material	Not applicable. No soil is removed in this Alternative.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transportation requirements.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transportation requirements.	Hazardous materials will be transported by a licensed hazardous waste transporter in accordance with state and federal transporation requirements.

TABLE 9.2
COMPARISON OF ALTERNATIVES
UPLAND OPERABLE UNIT
1990 Bay Road Site
East Palo Alto, California

Alternative and Description	Protection of Human Health and Environment	Compliance with ARARs	Long-Term Effectiveness	Reduction of Toxicity, Mobility, and Volume	Short-Term Effectiveness	Implementability	Cost (Net Present Value)
Alternative A	Not protective	No	Not effective	No reduction of M or V (T can not be reduced for the contaminants of concern)	Not effective	Implementation complete	$900,000
Alternative B	Protective	Yes	More effective than Alt. A	Reduction of M and V in soil and groundwater	Effective, ARARs met in short time	Implementable	$5,800,000
Alternative C	Protective	Yes	More effective than Alt. A, effectiveness comparable to Alt. B	Reduction of M and V in soil and groundwater	Effective, ARARs met in short time, same as Alt. B	Implementable	$6,200,000
Alternative D	Protective	Yes*	More effective than Alts. A, B, and C	Reduction of M and V in soil and groundwater, more reduction of M in soil than Alts. B or C	More short-term impacts that Alts. B and C	More difficult to implement than Alts. A, B, and C	$7,800,000
Alternative E	Protective	Yes*	More effective than Alts. A, B, C, D, and F	Reduction of M and V in soil and groundwater, more reduction of M in soil than Alts. B, C, and D	More short-term impacts than Alts. B, C, and D; ARARs met in shorter time than Alt. G and in same time as Alt. F	More difficult to implement than Alts. A, B, C and D; similar to Alt. F	$9,100,000
Alternative F	Protective	Yes*	More effective than Alts. A, B, C, and D; Less effective than Alt. E	Reduction of M and V in soil and groundwater, more reduction of M in soil than Alts. B, C, and D	More short-term impacts that Alts. B, C, and D; ARARs met in longer time than Alts. B, C, and D and in same time as Alt. E	More difficult to implement than Alts. A, B, C and D; similar to Alt. E	$9,500,000
Alternative G	Protective	Yes	Most effective; no long term maintenance	Near-complete reduction of M and V in soil and groundwater	Major impacts to community and business during implementation, longest time to achieve ARARs	Most difficult to implement	$85,000,000

*Requires short term waiver for treatment/redeposition

1220F

TABLE 9.3

ARSENIC-AFFECTED SOIL: COMPARISON OF ALTERNATIVES
UPLAND OPERABLE UNIT
1990 Bay Road Site
East Palo Alto, California

Total mass of Arsenic[1] = 74,800 kg Total volume of affected soil (>20 mg/kg) = 91,000 yd³	Alternative									
	B		C		D		E		F	
	Mass of Arsenic (kg)	Volume of Soil (yd³)	Mass of Arsenic (kg)	Volume of Soil (yd³)	Mass of Arsenic (kg)	Volume of Soil (yd³)	Mass of Arsenic (kg)	Volume of Soil (yd³)	Mass of Arsenic (kg)	Volume of Soil (yd³)
Soil Removed from site:										
- Early Action Removal (>5000 mg/kg)	14,100	1,420	14,100	1,420	14,100	1,420	14,100	1,420	14,100	1,420
- Early Action Removal (<5000 mg/kg)	5,900	840	5,900	840	5,900	840	5,900	840	5,900	840
- Future Removal	10,000 (13%)[2]	1,260 (1%)[3]	10,000 (13%)	1,260 (1%)	10,000 (13%)	1,260 (1%)	10,000 (13%)	1,260 (1%)	10,000 (13%)	1,260 (1%)
- Total Removal	30,000	3,520	30,000	3,520	30,000	3,520	30,000	3,520	30,000	3,520
Percent of Total Removed:	40%	4%	40%	4%	40%	4%	40%	4%	40%	4%
Soil Treated at Site:										
- Initial Phase (accessible areas)	—	—	—	—	11,900	4,330	15,100	7,600	15,100	7,600
- Future Treatment	—	—	—	—	16,800 (22%)	6,600 (7%)	22,500 (30%)	12,200 (13%)	22,500 (30%)	12,200 (13%)
- Total Treated	—	—	—	—	28,700	11,000	37,600	20,000	37,600	20,000
Percent of Total Treated:	—	—	—	—	38%	12%	50%	22%	50%	22%
Percent of Total Removed or Treated:	40%	4%	40%	4%	78%	16%	90%	26%	90%	26%
Soil Contained within Slurry Wall:	43,200	76,800	—	—	43,200	76,800	43,200	76,800	—	—
Percent of Total Contained within Slurry Wall:	58%	84%	—	—	58%	84%	58%	84%	—	—
Soil Removed, Treated, and/or Contained:	73,200	80,320	30,000	3,520	73,200	80,320	73,200	80,320	67,600	23,520
Percent of Total Removed, Treated, and/or Contained:	98%	88%	40%	4%	98%	88%	98%	88%	90%	26%

1 Mass and volume of affected soil based on Table 7 of the Remedial Investigation Report for the site (Geomatrix and SSP&A, 1989).
2 Percent of total mass of arsenic in upland operable unit.
3 Percent of total volume of arsenic affected soil in upland operable unit.

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10.0 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element.

Because the remedy will result in hazardous substances remaining on-site above health-based levels, a five-year review, pursuant to CERCLA Section 121, 42 U.S.C. Section 9621, will be conducted at least once every five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

There were no significant changes to the remedy proposed in the proposed plan fact sheet and the remedy selected in this Record of Decision.